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☞ An asterisk (*) denotes an illustrated article

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ELECTRICAL MEASUREMENTS.

In studying electrical phenomena several distinct quantities present themselves for measurement.

These are few in number; and upon the close adherence to the fundamental laws governing the relations existing between these quantities will depend the correctness of all calculations regarding them. The principal factors to be determined in electrical measurements are QUANTITY, RESISTANCE, and ELECTRO-MOTIVE FORCE. For each of these an accurate unit has been established by a committee of the British Association, of which Prof. Williamson was the chairman. These units are known as the B. A. units, and depend on no arbitary conditions, but are derived directly from the centimetre, the gramme, and the second, and reductions from one to another may be made without using any other factor than unity.

The following equations show the relations these quantities bear to one another, in which Q=QUANTITY; C=STRENGTH OF CURRENT; T=TIME; W=WORK DONE BY A CURRENT; R=RESISTANCE; E=ELECTRO-MOTIVE FORCE:

Faraday proved that—

$$Q=C.T. \quad (1)$$

or, the QUANTITY transmitted by a conductor equals the product of the TIME by the STRENGTH of CURRENT.

Joule showed that—

$$W=C^2.R.T. \quad (2)$$

or, the WORK done by a current equals the product of the TIME by the RESISTANCE by the SQUARE of the STRENGTH of CURRENT.

Finally, the law of Ohm gives—

$$C=\frac{E}{R} \text{ or } E=C.R. \quad (3)$$

or, the ELECTRO-MOTIVE FORCE equals STRENGTH of CURRENT MULTIPLIED by RESISTANCE.

Having these equations, it remained only to determine one of these units to enable the others to be deduced, and the unit of Resistance was selected by the Committee and was determined. A number of copies of the standard unit of Resistance were made, formed of coils of wire, made of 1 part platinum and 2 parts silver, the whole being imbedded in paraffine, and enclosed in a thin copper case. To use them they are placed in water which is brought to the temperature required by each to make them exact, this being marked on the case.

These units of Quantity, Resistance, etc., have also different names given them, which are derived from the scientists who have distinguished themselves in the branches of electricity to which they relate. Thus, the unit of quantity, Q, is called a Veber, after Weber; the unit of capacity, or strength of current, C, is called a Farad, after Faraday; the unit of potential or electro-motive force, E, is called a Volt, after Volta; and the unit of resistance, R, is called an Ohm, after Ohm.

To show the magnitude of these units, the following examples are given: A piece of copper wire, No. 16 (diameter, .06 inches) 60 feet long, has a resistance of about 1 Ohm. A Daniel cell has an electro-motive force of about 1.1 Volts, and a Grove or Bunsen cell, about 1.8 Volts.

BURNERS.

While so many people are anxiously waiting to see the electric light replace the present gas light, there is no doubt of one thing, and that is that it has not yet been accomplished; and although the patent offices, both in this country and in Europe, are crowded with applications for protection, in the manner of bringing about the adoption of the new system still, as yet, nothing has been presented that fulfills all the requirements of the case.

And when the question of distribution is reached the electricians will find a harder problem to solve than any they have yet been called upon to deal with. While the electric light is advancing and seeking to find some place wherein it may establish itself, or, in other words, while the proper sphere of usefulness for the electric light is being practically determined, we would urge upon those supplying gas light the importance of leaving no stone unturned to improve the quality and character of the commodity they have for sale in an established market. If one-half the time, energy and money that has been devoted to the application of electricity to lighting purposes could have been concentrated upon the one subject of properly burning the gas, as it is now made, there is not the least doubt but that the gas maker would be in a position to show much better results, in quantity and cost of light, than he now can. It is useless to make good gas and have it thrown away by being only partially consumed in bad burners; and even

the best burners that we have are not, by any means, able to give the results they should give.

As an indication of what may be done, we would cite the results of the efforts of a single engineer in England. The Sugg standard burner gives the light of from 16 to 20 candles, by the consumption of five feet of gas per hour, His Double-Ring Argand gives a light of 60 candles, with a consumption of 12 feet, and the large Triple Ring, which was exhibited at the last meeting of the Association, gave, by a careful test, a light of 196.6 candles, with a consumption of 30 feet per hour.

These facts show the direction in which effor should be made, and we are fully convinced that, if an intense light is required, it can be produced by gas *properly burned* better than from any other artificial source.

KING'S TREATISE.

Bound copies of Volume I., of King's Treatise, on the Manufacture and Distribution of Coal Gas, are now ready and for sale at $10 per Volume.

To those who have neglected to subscribe for this most valuable publication, as it has appeared in monthly numbers, this affords a rare opportunity for procuring the first volume of the latest, fullest, and most complete work on this subject. The work is published by the *Journal of Gas-Lighting*, London, and is edited by Thos. Newbiggin, M.I.C.E., and W. F. Fewtrell, F.C.S. Orders sent either to Chas. Nettleton, 150 Broadway, New York, or to this office, will be promptly filled.

The Edison Light and the Silly Birds.

Light *versus* Darkness? Why, no—not quite,
'Tis rather a question of Light *versus* Light.
Yet these fluttered creatures—a foolish flight—
Are blind and noisy as birds of night,
Owls, gulls, and noddies, who, scared at the sight
Of the the kindly glare from the light-house height,
Dash themselves dead in reason's despite.
Mr. Punch would gladly some words indite
To allay the fluster and bletherumskite
Too often aroused by occasion slight;
To sober counsels would fain invite
Each prematurely despondent wight,
Who sees but ruin about to alight
On Gas Share, and Profit, and Company-right;
Who woful wails to the papers indite
About empty coffers and markets tight;
To prove quite clear that foresight is fright,
That Gas Shares must come down like a stove-in kite,
That light is darkness, and black is white.
Cease, fools, your brainless heads to smite
Against an improvement of too much might
To be stayed by fear of your hopeless fight.
There's room for all, and this Edison Light,
With its lightning flash bringing day into night,
Will prove a blessing, and not a blight.
The shoe may pinch, as shoes will, when tight,
But Panic is madness—tis true, as trite:
A Hundred Millions is a sight
Too much to be gulped in a stock-exchange bite.
Then cease bewailing your piteous plight,
Hold to your Gas Shares tight and tight,
And you'll find that things will work themselves right,
Nor knock out your brains on the Edison Light.
—*Punch.*

Electric Light in Denmark.—The electric light is about to be tried on the Copenhagen forts, and will light up a large expanse of the Sound.—*Polytechnic Review.*

The Flicker in Gas.

The following article and the above cut appeared in *Mayfair*, a weekly London journal, Oct. 22, 1878. The writer evidently is posted on some points regarding the electric light:

Whatever may be the ultimate issue of the contest between gas and the electric light, one phase of it is matter for present regret. We are supplied in the case of the gas shareholders with another illustration of the readiness with which people contribute to their own injury by yielding to unreasoning and ignorant panic. The electric light has been exhibited in Paris and at home in its most approved and applicable forms, for considerably over a year; great attention has been bestowed upon it by the public, the press, and by scientific men; yet proprietors of gas shares showed little sign of fear, and their property suffered slight depreciation. But one morning, we are informed by telegram from the other side of the Atlantic, that a gentleman, whilst vigorously, but apparently aimlessly, turning the handle of an induction coil, informed a reporter on the *Sun* that he can improve the light in the direction of making it more applicable for general use; and on the strength of this bare, indefinite, entirely unsupported statement shareholders lose their heads, and in a week there is a depression of 20 per cent.—equal, on the value of London gas property alone, to a reduction of 2½ millions sterling. Such a fall, induced by such a cause, is so absurd that we should feel little symdathy with the victims, did not experience teach us that those who suffer most at such times are those who can least afford it. It is the timid holders of small amounts who fear to lose their all.

The electric light has now taken its place as a method of illumination, available for certain places and under certain conditions. Every improvement tending to cheapen its production, or to bring it more under control, will increase the sphere of its possible application; but in all such situations its promoters will have to show not only that the new light can do the work, but that it can do it better and at less cost than the old one.

Gas must always retain certain advantages over electricity which are of considerable weight. It is immediately available, without trouble to the user, who can regulate the amount of light exactly as he pleases. He can have the light of thousands of candles at one moment, and that of a simple reading lamp or bed-room rush-light the next; and he knows that when he turns off his gas the cost ceases.

With the electric light the lamps must be prepared, watched, and kept in order. Their can be no regulation of the amount of light; from the full blaze there is no change short of actual darkness.

Again, there are many positions in which it is necessary to have lights burning all day. For such situations it would clearly be impossible to use electricity, involving, as it would, the keeping up of steam and the working of machinery all day. As there can be no storing of the electric light, it is necessary to provide apparatus equa to the production of the greatest quantity required at the moment it is needed; the whole expensive apparatus would thus be in full work for, say, six hours on a winter's night, and then either idle or working extravagantly for the remainder of the twenty-four. And at present the electric light necessarily brings with it to the premises of the user, engine, machine, boiler, and stoker, with the usual accompaniment of noise, smell, and dirt.

But it is only those who know very little of the matter who entertain the idea of competion along the whole line. Those who are doing most to render the electric light of practical value repudiate any such expectation. M. Fontain expressed the views of many eminent electricians when he said: "The electric light does not interfere with gas light; it will not revolutionize—as has been often averred—the question of lighting, destroying what is now in use, and monopolizing every industrial application, domestic and public. The electric light has its place marked out for it under many circumstances, but, far from diminishing the consumption of other lights, it will lead to their further development by demonstrating the advantages of a more complete and more powerful illumination. The field of operation is extensive, and will remain open for a long time before it is fully occupied. But it certainly does not represent a hundredth part of the whole system of lighting."

The field open to the electric light is a large one, but it is one, we venture to predict, which will interfere to no injurious extent with that of gas lighting. If the public, familiarized with the more thorough illumination of such spots as that about the Gaiety Theatre at this time, would

compel the vestries to improve in some way the general lighting of our streets, a great blessing would be obtained. The appearance of most of the metropolitan streets and roads after the shops are closed is dreary and dark to a degree. It is amusing to hear of vestries receiving reports as to the adoption of electric lamps, which would cost over £200 each per annum, when they are so niggardly in the erection of gas lamps costing about £4.

It is clearly, however, a mistake to set down street illumination as a part of the work electric lights are specially adapted for. Light-centres of great intensity, at considerable distances apart, would be an embarrassment. In Paris the electric lights are at no greater distance apart than the gas lamps were. The effect is, therefore, fairly uniform, but the cost is very great. For instance, in the Avenue de l'Opéra, and the space at either end, are fixed, in all, 64 electric candles, for each of which, we are informed, the municipality pays 1 fr. 25 c. (say one shilling) per hour.

The hours of darkness during which gas lamps are burning amount to 4,200 in the year; consequently, if these lights were kept burning all night, and every night throughout the year, the cost would be £13,440. Each of these electric lamps has displaced six gas lights, or a total of 384. In Paris the public lights are supplied with gas at half the rate paid by private consumers, consequently about the same as in London. 384 lamps, each consuming 21,000 cubic feet of gas, at 3s. 6d. per thousand, would cost £1,411 per annum. Careful photometrical observation has shown, however, that the available light from each electric candle is equal to ten gas burners. To bring up this deficiency of gas light, would raise the £1,411 to £3,344, and the comparison would then stand, light for light, as between that sum and £13,440. It is stated that the cost of carbon pencils alone—apart from steam power, machinery, and interest on capital—in an electric lamp such as those used in the streets of Paris, is 5d. per hour. The total cost of the equivalent ten gas lamps would be 2d.

The electric light must not only become cheaper, less intense, amenable to regulation, and steadier in operation, but it must convert the ladies from their very general dislike before it can find its way into general use.

The light is harsh and cold when compared with an equal illumination by gas. On the occasion of the late National Fête in Paris a very extensive display of the electric light was made at the evening illumination; the effect was universally spoken of as poor and tame when compared with the rich and glowing effects of the gas, and the same absence of warmth and color would cause it to be pronounced a failure in ballroom or theatre.

Gas is now in increasing demand for warming and cooking purposes, and also as a motive power; gas engines have proved themselves both safe and economical. In London, it is said, only about one-fourth of the inhabited houses are supplied with gas; there is consequently a large field open to the companies in which there is no competitor. The electric light will, to a large extent, create the demand it will satisfy, and the two systems may consequently go on together, neither opposing nor hurting the other. There are no facts yet published of a character to justify the alarm manifested by the holders of gas property. We may reasonably hope that the fright they are having will stimulate them to supply gas as good and at as cheap a rate as possible, and so keep themselves as safe as may be in any competition.

[Official Report.—Continued from page 229.]

SIXTH ANNUAL MEETING OF THE AMERICAN GAS-LIGHT ASSOCIATION.

HELD AT THE FIFTH AVE. HOTEL, N. Y., OCT. 16, 1878.

Mr. McIlhenny then read a paper on the government of gas works, as follows:

The Government of Gas Works.

The subject on which I propose to offer a few remarks is, "The Government of a Gas Works, or How a Gas Company should be Governed."

In the management of all undertakings organization is of the first importance, and in no kind of business or manufactury is this of more importance than in the production and sale of illuminating gas.

You will observe that in the manufacture and sale of gas there is, perhaps, a more close and intimate relation than in almost any other kind of traffic, because the great difference between the amount made and that sold involves so large a moneyed consideration. Again, the character of the business is unlike almost any other in the variety of knowledge necessary to secure successful management, there being mechanical and chemical knowlege required—business and executive ability necessary. In view, then, of the great value of proper organization to a business of this kind, it is proper here to remark that there is, perhaps, no interest involving so much pecuniary consideration, where there is a greater variety of organization, or less concert, as it is but seldom found that two companies are working in the same way. While circumstances may require some difference in the management, there is no excuse for the great difference in the method of conducting this business (if any system can or ought to be taken as a standard), and that there should be some rule regulating this, as in all other important matters, is manifest.

Companies are usually organized with a board of directors as the governing power, and they, in turn, elect one of their number as president, a secretary, and sometimes a superintendent, but frequently this officer is appointed by the president. The board of directors can have but little to do with the detail management, and, of necessity, look to their officers for the performance of all necessary duties. The president, being the head of the company, is properly and rightfully the ranking officer; and in the selection of a man to fill this important position the greatest care should be exercised, in order to secure one who combines all the qualities required, and these I assume to be, first of all, good common sense, active business energy, a knowledge of banking and finance, a man generally well informed, and, of course, a gentleman. If you can combine these qualities with social and financial standing, mechanical and engineering, or chemical knowledge, you have a man eminently fitted for the place.

The secretary is also an important officer, and the choice of this man should be made with great care. He should be a man with uniform urbanity of manner, good and courteous address, intelligent, popular with the public, and familiar with the social and financial standing of the consumers, a man acquainted with general business matters, energetic and honest, with executive ability. Of course it is much easier to describe these qualities than to find them; but we are now trying to fix a standard.

The superintendent, and this I assume to be the proper title for a manager of a gas works—that of engineer, so commonly applied to the holder of this position, is frequently erroneous, because, in many instances, managers have but little knowledge of engineering, and when that quality is required some other person is called upon to supply it. I claim, moreover, that superintendent is a title of more dignity and propriety than engineer; but when the manager acts in the capacity of both then his title should be engineer and superintendent.

The qualifications of a superintendent should be mental and physical vigor—both are indispensable. He should have a comparatively extensive knowledge of the several branches of science relating to his business. He should be a good mechanical engineer, understanding and having a knowledge of both rough and fine work; and if he were a practical mechanic, machinist or millwright, it would be to his advantage. He requires a knowledge of building in stone, wood, and iron work. He must, of course, understand how to construct every part of his works; and, if necessary, ought to be able to do it himself. He ought to know how to manipulate his material for the production of crude gas, and when he has done this he must be familiar with the means of condensing and purifying it. He ought to have the faculty of managing men, and should have much force or executive capacity. Because of his intercourse and dealings with the public and corporate bodies, he should be a man of good address and agreeable manners, and understand well the relationship of his company to the public, in order to best protect its interests. His intelligence and position, as executive officer of an important institution in the city or town in which he lives, should enable him to secure and retain a first-class social standing; this is desirable in every man's case, and it is particularly so in that of the manager of a gas works.

Having endeavored to describe the qualities that should be possessed by the principal officers, I now propose to define their respective duties. First we will refer to the president, who, when he is placed in this high and responsible position by the owners, is expected by them to guard well their interests; and under the influences by which those gentlemen are frequently elected, the necessity of proper organization is apparent. We are all aware that men are as often chosen to fill this important place for expediency as for special qualifications, and in many cases are chosen from business circles without any previous training, or mechanical or engineering skill. I do not say that this is not sometimes right, and the best selection is doubtless made that can be made by a board of directors who are looking for results and dividends by means of some astute manipulations, and frequently, as in all kinds of business, the right man is selected; and the company is to be congratulated that makes this lucky choice, because so much depends on him. The duties of the president I claim to be a general supervision of the entire affairs of the company, without any special detail to perform himself; and in the division of this work he ought to have but two responsible heads, the secretary and the superintendent. To the the first belongs everything relating to gas after it leaves the burner—such as the control of every man, clerk, meter taker, and other persons in his office, keeping all accounts, collecting all moneys, and looking strictly after the correct registration of the meters, by requiring his assistants to make careful comparisons, and report any apparent defects.

His office should be conducted on the best, simplest, and yet most comprehensive system; and it is of great importance that some uniform

method should be adopted and applied to this important branch of the business

In order to ascertain the best system for the conduct of this branch of the business, the president and secretary should examine the methods of other companies, visit other cities, and get a personal knowledge of the workings and systems in use, and should adopt whatever of their methods would be suitable and useful to them. It would perhaps be difficult to establish an exact rule to apply to the manner of conducting the business of the secretary's office, as circumstances will probably require some difference in nearly every place, and it is not absolutely necessary in this case, so that an efficient and comprehensive system be adopted.

It is in the execution of the duties that the effort should be made. The secretary should, as has been said, have control of all the details after the gas leaves the burner, and for the performance of these duties the president should look to him. Neither the president nor any other person should interfere in the details by giving orders independent of the chief officer, because such conduct always tends to lessen discipline and create confusion. The president and directors should enforce their rules through the proper officers.

The custody of the money should be intrusted to a treasurer, who will give the necessary bond. All moneys should be paid over to him by the clerks or collectors, as the case may be, and a receipt given by him to each man whenever payment is made. A receipt book for this purpose should be provided. The treasurer's accounts ought to correspond with the amount of gas sold, less the delinquent bills. A bank or banks should be designated by the board of directors, in which he shall deposit the money; and when this is done, and proper returns made to the secretary, his responsibility ceases.

All payments should be made by checks drawn by the secretary and countersigned by the president, and all bills for which checks are given should be approved by the proper officer—by the secretary when contracted for his department, and by the superintendent when belonging to his department; and no payments should be made except upon properly certified vouchers.

The success of the company will depend largely upon what is known as results, which means chiefly the manufacture and sale of gas; and the management in this direction will be a guarantee for either success or failure. Indeed, it may be said that the very existence of the company depends on this. Hence the great necessity for having the very best management in this department that can be obtained. And there has perhaps never been a time in the history of the business when the necessity for this has been more apparent than now, because of the tendency for cheaper gas, and the rivalry of other lights.

I have previously stated, in defining the duties of the secretary, that he should have charge of everything after the gas has left the burner; and now, in defining the duties of the superintendent, I claim that he should have charge of the gas before it leaves the burner, which covers all the details of manufacture and distribution.

He should employ and discharge every man in his department; his authority to purchase will depend largely on the confidence of his company in his judgment and ideas of economy. He should have control of the manufacture and distribution, and be responsible for both.

Coal purchased should be paid for by the weight received at the works, and all coal sent into the retort-house should be accurately weighed and the account proved once a year, by working out the coal received, or obtaining, by exact measurement, the weight of that on hand. That is—the coal account should balance at the end of the year.

It is obvious that the great effort should be to sell the maximum amount of gas, of proper quality, to the ton of coal; and to secure this end it is of the utmost importance that the manufacture and distribut on be under the control of one man, because when more than one is managing it there is a divided responsibility, and there cannot be other than confusion of council and conflict of opinion, if not of authority. Two captains cannot sail the same ship, nor two men manage a gas works. There must be a head which will have the authority and responsibility.

The most important part of the superintendent's duties is at the works; here is where the most of the money is either lost or made, and to this part of his business he should bend the principal portion of his ability and energy. The works should be his headquarters, and there nearly all his time should be spent, even if he has nothing particular to do, his presence is needed to influence others, and it is highly important that he should have a personal knowledge of everything that transpires; to have this he must see it. It is a mistake, which is often made, to suppose that a gas works can be managed successfully from an uptown office, or by a telephone; nothing but the strictest personal attention will secure the best results, nor can chance be relied on to produce these, they come not in this way, but are the result of study by day and night. Indeed, the intelligent and thoughtful superintendent never loses sight of his business, his mind is always active, and no opportunity is allowed to pass where he can improve his company's condition.

The necessary power and authority being placed in his hands, his responsibility is, of course, in proportion; and having obtained the power he requires from the president or directors, it then becomes a serious question what they shall expect of him. What they have a right to expect and demand is, in the first place, the very best general management. As to results, there should be no excuse offered; nor any accepted, for failure; on the contrary, I am of the opinion that a standard of results ought to be established by each company, such as gas sold, make per man and retort, and cost delivered to the consumer. This can easily be done by taking the best results of other companies, and requiring the superintendent to equal them, because there is no reason why as good results cannot be made in one place as in another where the same, or as good, material is used; if there are difficulties, he should overcome them, except, perhaps, those of a climatic nature. I believe this the best method of bringing about the best results.

As the president has but one man to look to, and if he, the president, knows what is required, and the superintendent fails to fulfil the standard he must admit his failure and might realize that he had missed his calling. It cannot be other than gratifying to a superintendent to know that his results are among the best, for they are his stock in trade, his capital; and it is equally as much to his interest as to that of his company that they should be the best, because they never fail to be appreciated.

In this, as in all other callings and professions, there are some men who have superior capacity, and it cannot be expected that a superintendent can acquire all necessary knowledge at home, or in the city in which he lives. This would be unreasonable; therefore the company should afford him every opportunity for obtaining information, by sending him to other cities in this country, and it would be to his advantage if he were permitted to investigate works in foreign countries. He may get but few ideas, but he is certain to learn something that will be useful in his business, and it will take but very little in this respect to fully compensate his employers for the small expense incurred. Aside from the advantages secured by general information, anything that facilitates the acquirment of knowledge on his part is sure to redound to the benefit of his employers.

It becomes a question how men possessing this merit in the gas profession should be compensated, because it is clear to me that they should share in the emoluments that their abilities have secured for others. This principle is recognized in nearly every vocation in life. A successful statesman, soldier, or patriot is rewarded by his grateful country; the lawyer, doctor, and mechanic, who possess superior abilities in their various occupations, are generally rewarded by their large fees and extensive business; and in the mercantile line men possessing ability or influence, which in that business amounts to the same thing, are taken into partnership, or in some way recognized.

In the gas profession, however, no opportunity is given the manager to share in the profits, no matter what his success may be, except by his compensation in salary. This sometimes is liberal, but often otherwise. It is but seldom that the superintendent owns much of his company's stock, and he generally remains so poor that no matter what may be the prospective or actual profits, he can get none of it.

Now, in view of these facts, it seems to me that there ought to be some rule or custom established allowing a certain percentage of the value of results after they reach a certain limit to go to the superintendent; and while this would be only simple justice, it would stimulate men to make extraordinary efforts, and the man who failed to accomplish something under such circumstances might be truly pronounced a failure.

The organization, then, will be as follows:

The superintendent to have charge of everything until the gas leaves the burner, and the secretary to have charge of everything connected with his office after the gas leaves the burner—both to be responsible to the president, and neither to interfere with the duties of the other.

If either fails to meet the requirements demanded by his office, the president has but to show this, and hold each to a strict accountability.

Of course the performance of these duties will depend largely upon the capacity of the president to determine when they are properly executed, as he ought not to accept less than agreed upon, or expect more.

On motion, a vote of thanks was tendered to Mr. McIlhenny.

Mr. Cartwright—There seems to be some misunderstanding in regard to the phrase used by Mr. McIlhenny, in the paper which he has just read, and it may perhaps be well to have it explained. He spoke of the control of the several officers which he has named, ending with the burner. I think it would be a little more satisfactory if he would make that expression a little more explicit. Does he mean that the control ceases at the end of the burner, or when the gas leaves the burner?

Mr. McIlhenny—The language used is that the secretary should have charge of everything after the gas leaves the burner which includes all

the bills, and that the superintendent should have charge of everything before the gas leaves the burner, which includes everything up to the time the bills are made—meters, street mains, the works, and all the details incident to the production and distribution of the gas.

Mr. Littlehales—I presume it does not come within the scope of the secretary to trace the gas from the burners. I suppose his duty ends at the meter rather than at the burner. I presume that those who copied the paper did not copy it right, and the term "meter" should occur where the term "burner" occurs.

A member—The presumption is that there is no loss between the meter and burner.

Mr. McIlhenny—Bills, of course, are made out at the meter; but the consumer knows nothing about the gas until it reaches the burner. That is the proper point of designation between the time it leaves the holder, and the time it is registered on the bills, or on the meter, which is the same thing. I make the burner the dividing line between the duties of the two officers, the superintendent and the secretary. Of course I am not laying this down as a rule. I do not suppose there are many who will follow it; but it seems to me that, in order to simplify these things, and in order to get the best results, it is necessary to divide the responsibility in some way; and I have done it by making the secretary responsible after the gas is registered, and the superintendent responsible before it is registered.

Mr. Herzog—There is one thing to which Mr. McIlhenny refers, and which he desires should be introduced here, that has been put into successful operation in the large Continental gas companies, and that is giving the superintendent a share in the profits to a certain extent. Some of these large companies pay their superintendents a small salary, and, at the same time, give them a percentage of their earnings. I believe that is the just and fair way for the companies to do, and it has worked very successfully there. In one place in Germany they have about 15 or 18 gas works, and they give their superintendent a certain proportion of the net earnings of the company; and the talents and ability of the superindent contribute to the prosperity of the concern.

Mr. Neal—I really do not think some of the members understand what Mr. McIlhenny means by the secretary to have charge of the gas after it passes the burner. I do not think that is exactly what he means, because, after the gas passes the burner or the meter, what control has the secretary over it? He has sold it, and it passes out of his hands. I apprehend that he means this: that the secretary is to have control of the meter after the gas passes it. After the gas passes the meter I do not see how he has any control over it.

McIlhenny—What I said was that the secretary should have control of everything after the gas leaves the burner.

Mr. Neal—What is everything?

Mr. McIlhenny—All the details.

Mr. Neal—The gas has passed the meter and burner, and now everything, as Mr. McIlhenny says, is in charge of the secretary. He makes out the bills, he collects the bills from the consumers, and the money is paid over to the treasurer. So it seems that the secretary does not have control of quite everything. I think the money that is paid over is quite an important element.

Mr. McIlhenny—I stated in the paper that the secretary had charge of the clerks and meter takers, and all the details incidental to the collection of the bills; and that the money was to be paid to the treasurer. and that he was to deposit it and make a correct return of it to the company.

Mr. Harbison—I think there is one point in connection with Mr. McIlhenny's paper that the Association did not take in, and that is this: as he was reading his very interesting paper, and as the points were being brought out, it was very clear to me, as he looked around the room, that he must have had a very intimate acquaintance with the personal merits of the members of this Association. In defining the qualifications that are necessary for a first-class president, he had in view, I am sure, half a dozen gentlemen who are present; and when he was defining the duties and qualifications of a secretary, he also cast a meaning glance around the room. I want to call attention to this point, because it shows that his acquaintance is not simply limited to gas making, but he is also well acquainted with the qualifications and the calibre of the members of this Association. [Laughter.]

Dr. Sloane then read a paper as follows:

Relation of Theory to Practice in the Gas Flame.

It is well known to us all that heat, in its industrial applications, is wasted to a great extent. The old problem of the conversion of heat of low into corresponding heat of high temperature, has to be solved, and to its non-solution the waste in most cases is due.

Theoretically, one pound of coal should melt forty pounds of iron, yet this result is never even approached in metallurgical practice.

I wish to examine very cursorily the loss of heat in a gas flame. Light is here produced by intense heat; the combustible gases are peculiarly fitted to produce such heat, because, as they are already in the gaseous state, they do not in their combustion have to make the step from solid to gaseous, as solid combustibles do.

The light given by the flame is due to the ignition of particles of solid matter. Carbon is present in the unignited gas in combination with hydrogen, as constituent atoms of gaseous hydrocarbon. When the gas burns, the heat of the flame decomposes these compounds; solid carbon, in a state of almost molecular division, is liberated; and becoming white hot or incandescent, emits light. It travels upward through the flame, until, reaching the top and outer zones, it is burnt into carbon dioxide, commonly called carbonic acid gas.

All the light of gas is due to the ignition of this carbon. The proof of this fact is this: while gases and liquids ignited may give light, it can always be determined by spectroscopic analysis whether light is due to an ignited gas or not. Theoretically and in fact, the spectrum of light derived from the ignition of a gas is discontinuous, while liquids and solids ignited give a continous one. On subjecting the light of illuminating gas to this examination, it is found that it is due to the ignition of solid or liquid matter, because its spectrum is continuous. As there is no reason for the belief or probability that there is a liquid there present, we find that its light is derived from an ignited solid; and by analysis we find that carbon is the only substance present that remains in the solid state at elevated, or even ordinary temperatures.

This proves the fact. A *quasi* proof is found in the deposition of carbon, in the form of lampblack, upon a cold body immersed in the flame. Therefore, as a light producer, all the work of a flame is the heating of carbon to a white heat.

I shall now proceed to consider the arithmetic of the process, to show what waste of heat takes place, and what a sacrifice of economy to convenience the whole operation is.

I will start with a gas composed of the following prncipal constituents:

	By Weight.	By Volume.
Hydrogen (H).....	5·00	50·00
Marsh gas (CH_4).....	63·00	39·40
Carbon monoxide (CO)	19·00	6·70
Olefiant gas (C_2H_4)...	11·00	3·93
Water (H_2O).....	2·00	1·11

This represents about such a gas as is now delivered in New York. For ease of calculation, I will use the analysis by weight, and refer everything to 100 parts of the gas.

The olefiant and marsh gases supply the flame with its solid carbon; and, to make every allowance, we will assume that all the carbon contained in them is dissociated, and plays its part in producing the light of the flame. They contain 56·67 parts of this carbon. The heat developed by burning each of the combustible gases has been determined by physicists. If we multiply the amount of hydrogen and other combustible gases, each by its own heating power, we shall have the total heating power of the flame. Thus, one part (by weight) of hydrogen will raise 34,462 parts of water one degree centigrade; therefore, $34{,}462 \times 5 = 172{,}310$ is the number of parts of water which the five parts of hydrogen in the gas under consideration will raise one degree centigrade in temperature.

Performing a parallel computation for all the constituents that will burn, we find that 100 parts of the gas will raise 1,169,317 parts of water one degree Centigrade. 1500° Centigrade is not far from the temperature of the incandescent carbon. We will assume that this number of degrees of heat has to be imparted to the carbon by the flame. Dividing 1,169,317 by 1,500, we have 779·5, the number of parts of water which one hundred parts of gas will raise 1,500° Centigrade. But 100 parts of this gas, in their combustion in air, will have to heat 815 parts of nitrogen derived from the atmosphere. Multiplying this number by .2438, the specific heat of nitrogen compared to water, we obtain 198.69 the corresponding weight of water. This, plus the water in the gas, must be subtracted from the total work. Doing this, it gives as a result that one hundred parts of our gas should be able to raise 578·8 parts of water 1,500° C. If we divide this number by ·2411, the specific heat of carbon, we shall have the corresponding weight of carbon, or 2,400. Dividing this (the theoretical) by 56·67 (the actual) efficiency of gas, we obtain 42·4 as the figure expressing the relation of theory to practice; in other words, the gas in its combustion generates enough heat to produce 42·4 times the light it does.

The efficiency of gas I have determined on the supposition that all the carbon in the marsh gas plays its full part in the illumination. But this is not true; the light is due almost entirely to the olefiant gas. The supposition that it is the carbon of this constituent mainly that is dissociated and made incandescent is more than probable.

This carbon in the gas under consideration amounts to 9·43 parts. Substituting this figure for 56·67 in the former calculation, our ratio of practice and theory is expressed by 254·50; or the gas generates enough heat to produce 250 time the light it actually does. This figure seems, and I am not at all ready to say it is not, extravagant; but even if it is so, the other one, the first deduced, is too small. The truth lies somewhere between the two, and indicates at least a field for experiment.

On motion, a vote of thanks was tendered to Dr. Sloane.

Mr. Littlehales—I would like to inquire what is the best means of ascertaining the temperature of a gas flame? Perhaps some members may know some ready method of doing so.

Dr. Sloane—I will refer that matter to Major Dresser, who, I believe, has made some experiments in regard to the heat of retorts, and I suppose he will be able to give you information upon that subject.

Major Dresser—The experiments I made were not to determine the flame temperature of the gas burned, but they were a series of experiments, in rather a primitive way, for the purpose of determining the heat that was generated inside of the retorts. The method we used was as follows:

We had first six cast iron bars, of equal weight; then we had a little iron brigde or groove, with a stand on one end of it (the outer end), and that groove was laid on the charge, and reached about half way into the retort. Then these iron bars had let into them a piece of soft iron, shaped so that we could take hold of it with a small pair of tongs. We used the tongs for the purpose catching hold of the bar and sliding it down this little incline into the middle of the retort. The self-sealing lid of the retort was then shut, and the bars were left there for different lengths of time. Then the bars were taken out at different periods, say half an hour, an hour, an hour and a half, and so on. As the bars were taken out they were thrust into water, the weight and temperature of which were known; then, by noting the rise in the temperature of the water that took place from the heat that was thrown out by the iron, a calculation was made, by an ordinary formula, given in the Journal of November 16, 1877, for determining the heat of the iron. In these experiments we took the specific heat of the iron at ·126. The same experiments have been tried by Mr. Greenough, in Boston, and elsewhere, I believe, and the results, in most of these cases, corresponded very nearly. Of course the method is not an absolutely accurate one, but, at the same time, if a series of experiments are conducted under the same conditions, they will give the same relatively correct results. The vessel into which we thrust the bars was made of galvanized iron, about two feet long and perhaps one foot deep. That was weighed each time. We used the same weight of water, for facilitating the calculation. In each case the temperature of the water was taken before and after the immersion of the bar.

We had, as I say, six of these bars of iron, and when we pulled out one from the retort we put in another.

The putting in of this little bridge or groove, and sliding these pieces of iron into the retort, was found necessary, because it was difficult to see where the iron went when it was put into the retort. We found that sometimes it would slide down under the coal, and sometimes it would just touch the top of the charge; and in order to make the results reliable we found it was necessary to place the bars in the same relative position in each experiment. We found that in order to make a fair average it was better to put the bars in the middle of the retort, on top of the coal; and, as we could not see where the bars went every time they were inserted in the retort, this bridge or groove was used for the purpose of a guide, to enable us to put the bars into the same place.

Mr. Littlehales—I am very desirous of finding out whether there is any practical method for ascertaining the temperature of the retorts. We often hear gentlemen speak of their retorts being at such and such a temperature; and I would like to know if there was any method known by which we can test what the temperature of the retorts may be, and be sure that we are right.

Major Dresser—You can get at the temperature by this means. There is a certain formula which I do not carry in my mind, but which I can get very easily and give you at some future time, containing certain unknown quantities, and these unknown quantities are supplied by the temperature of the water before and after the immersion of the bars. Then, by working out the equation, it gives the temperature of the iron. I can give you the equation, and explain the matter to you, at any time.

Dr. Sloane—What is the weight of these bars of iron, or the general size of them?

Major Dresser—The pieces of iron that we used were perhaps an inch and a-half or two inches in diameter, and about one foot long.

Dr. Sloane—You immersed them in a tank constructed of galvanized iron?

Major Dresser—Yes, Sir.

Dr. Sloane—Was there a strong evulsion of steam?

Major Dresser—No; there was not.

Dr. Sloane—That was done away with entirely?

Major Dresser—Yes, Sir. Of course the bars had to be handled very quickly and very skilfully. In performing this experiment you need the services of a handy man to do some of the work, and then you can stand around and make the figures. (Laughter). You want a man who has got some intelligence and dexterity, to handle the tongs, and not allow these pieces of iron to fall on the floor.

The Jablochkoff Candle.

I wish to say that, through the kindness of Mr. Rowland, I have here a Jablochkoff candle, which came from the laboratory of Mr. Jablochkoff. He kindly gave me one for the benefit of this Association, but I have given it to Prof. Morton, and Mr. Rowland has let me have this one that he obtained in Paris. Mr. Jablochkoff told me that they could not be bought—that they were not for sale—and that he had no right to give them away. He said he would give me one with a great deal of pleasure; but that it was only in case they were for the use of scientific societies that they were presented. I immediately presented a card upon which I had printed quite a list of places that I frequent. One of the announcements on the cards was that I was an honorary member of the American Gas-Light Association, and another was that I was the secretary of the Society of Gas-Lighting, and one or two other things. Immediately, upon handing him this card, showing that I belonged to so many scientific bodies, he presented me with a candle which you will see to-night. Mr. Rowland, I presume, obtained one in a similar way. (Laughter and applause.)

These two little black streaks are the carbon, and the white streak is the kaolin, or plaster of Paris, that separates it. They put four of these on a stand and lead wires up to them. The current used by Mr. Jablochkoff is an alternate one. He has two machines—a large one and a small one; and by that means one of these carbons would be positive at one time, and the negative at another. So that the current goes from one to the other alternately, and in that way he secures an even burning of the two carbons. They burn down nearly the whole distance, and burn down quite evenly. When one of them is nearly burned out a man has to go to the lamppost where they are, and, by a switch, he switches the current from the one that is burned to the next one, and so on. One of these candles will burn from an hour to an hour and a quarter, and as there are four to a lamp they will burn about five or six hours, and then they have to be replaced by others. You observe, therefore, that that costs something, in the way of expense for attendance. The light furnished by these candles is quite a steady light for an electric light.

They are burned inside of a large oval globe, about twenty inches in diameter. Of course there is a certain loss of light from the use of these translucent globes, but the object in using them, as explained to me by Mr. Jablochkoff himself, was to present a larger surface, so that he could get more diffusive power, showing that even in Russia they have the true idea of light—namely, that its diffusive power depends upon the surface of the flame, and that a large burner gives more light in proportion than a small one. I do not think that Prof. Morton will be able to show this candle very well to-night, because I do not think that he has one of these alternate current machines. He might light it, just to show what the light was, but he could not display it properly without the proper machine.

The moment these carbons get separated a certain distance the voltaic arc would cease to pass. He takes the current around to four of these lamp-posts at once, and if any one of them goes out the others must go out. In the Orangerie, in the Garden of the Tuileries, they have forty-eight of these lights burning. These are run by two 35-horse power engines, which are worked to their full capacity, and three large electric machines and three small ones, for reversing the currents. That was the apparatus that was necessary for running the forty-eight lights.

Mr. Harbison—How long does it take a man to make a change from one candle to another on the lamp-post?

Major Dresser—The change from one to the other is made by the mere turning of a switch. Each one of these candles, as Mr. Jablochkoff told me, cost about 65 centimes, which is about 13 cents. I see, in a proposition that he made to illuminate certain buildings, he estimates the cost of these candles at 55 centimes, which would be about 11 cents. In the report which was published in the last number of the Gas-Light Journal, upon this matter, I averaged the cost at 12 cents.

Mr. Cartwright—How do they arrange the controlling power in lighting a long street, or a long row of lamps?

Major Dresser—They put the steam engines in the cellars of buildings, and their other machines in the same place. Wires are run from the machines to the lamps.

Mr. Littlehales—What is the greatest distance that the candles may be placed from the power?

Major Dresser—They claim that they can carry it about five or six hundred yards. You will find, however, that when they are making experiments in their laboratories, and even at the Exposition, that they prefer to use about two hundred feet of wire—that is, from their machines to their lamps—because it takes a smaller wire, and is more easily handled.

Mr. Cartwright—Do they have a return wire?

Major Dresser—Yes; they have a double wire.

Mr. Cartwright—Do they have the wires covered?

Major Dresser—They were all, apparently, covered wires.

Mr. Cartwright—How far apart are these candles lighted, generally speaking?

Major Dresser—On an average, one of these electric candles replaces about ten gas burners. I have just received, since this Association has been in session, a report made by Mr. Hunt, who is the engineer of the Birmingham Corporation Gas Works, and who was in Paris at the same time I was. He has kindly forwarded me a copy of his report, and, if you would like to hear what it is, I will read it.

Mr. Harbison—I move that it be printed as a part of the proceedings. Carried.

Major Dresser—Mr. Hunt is a man of a great deal of intelligence. He is a thorough gas maker; he is, at the same time, I believe, a perfectly fair-minded man, and is willing to find out everything he can in favor of the electric light.

Mr. Harbison—The reason I suggested that the report be printed with our proceedings is, that it is very possible that there may be those who, after hearing this interesting report read, will want to subscribe to the JOURNAL, in order to get the report.

Major Dresser—I think, after hearing this report, if a man is mean enough not to subscribe to the JOURNAL, we had better let him go. [Laughter.]

Major Dresser then read the report of Mr. Hunt, as follows:

CORPORATION OF BIRMINGHAM—GAS DEPARTMENT.

Report of Mr. Hunt on Electric Light.

I have to report that, agreeably with instructions received through the Secretary, I endeavored while in Paris (on the occasion of the visit of the British Association of Gas Managers) to procure such information as was obtainable on the subject of lighting by electricity, as partially adopted in that city—its cost, practicability and effect, for the purposes of ordinary illumination. I was further requested to prolong my stay, in order to witness the effect of the extensive preparations then in progress for a general illumination by means both of gas and electricity on the 30th June, the day appointed to be observed as a National Fête.

By the courtasy of M. Denayrouse, the Managing Director of the Electric Light Company, the members of the Association were permitted to visit the works of the company in the Avenue de Villars, and there inspect the apparatus in preparation for producing the electric light; and afterwards, on the same evening, were admitted to the Concert at the Orangerie, at which place 52 electric candles are in use, and where the engines and machines were open to the inspection of the members.

Subsequent interviews were arranged between M. Jablochkoff (the inventor of the electric candle) and five of our number, including the President of the Association and two American engineers, one being the Editor of the AMERICAN GAS-LIGHT JOURNAL. At each of these interviews I was present, and am pleased to testify to the patience and attention with which our inquiries were met.

The system adopted by the company, and to which my attention was mainly directed, as being the one almost exclusively employed in Paris, is that devised by M. Jablochkoff, the distinctive features of which are, as is well-known, the production from the same source of more than one light, and the employment of what is termed the "candle. This latter is an ingenious substitute for the lamp and regulator, with their attendant conveniences, and consists of two carbon rods, placed vertically side by side, and having between them throughout their entire length an isolating substance called kaolin. The intervening space between the rods being just sufficient to admit of the formation of the voltaic arc, is temporarily bridged over at the tip, which latter is ignited by the electric current, and the candle burns slowly down, the kaolin being consumed at the same rate as the carbon. I am able to produce one of these candles for the inspection of the committee. They were stated to cost 75 centimes each. Each lantern is provided with four, and sometimes five, candles, placed in sockets upon a brass table; and the electric current is communicated to one or other of them, as may be desired, by means of a commutator, worked with a switch arrangement, attached to every lantern. As each candle lasts, while burning, only from 1¼ to 1½ hours, constant attendance is necessary for the purpose of changing them—a difficulty which it seems possible might be overcome by means of some automatic arrangement.

The candles are enclosed in thick opal globes, 50 centimetres in diameter, equal to 19.68 inches English measure, which, while they diffuse and soften the light, effectually subduing its piercing brilliancy, very considerably diminish its intensity. It is admitted that the loss in this way amounts to 30 per cent. of the light generated; and, judging from the effect of similar globes upon gas-light, I believe it to be very much more. Each candle is estimated by the inventor to give the light of 110 carcel lamps, which, at 9.6 candles per lamp, equals 1,056 sperm candles; from this has to be deducted the 30 per cent. absorbed by the globe, leaving 739.2 sperm candles, as the available light given by each electric candle. This, however, is an evident exaggeration. I estimated the light at about 200 candles, and others with whom I conversed considered it comparable with about 15 ordinary gas burners—a value pretty much the same as my own.

The machine employed for producing the electricity is the magneto-electric machine of M. Gramme—a compact and powerful apparatus, to which I believe I am correct in attributing any practical success which has yet been achieved in the direction of distributing the light from more than one focus. As full descriptions of this machine have appeared in several scientific periodicals* in this country, it is probably unnecessary that I should refer to it in detail. Two sizes are now made—one capable of sustaining four lights placed upon one circuit, and a larger one for sixteen lights upon four circuits. The cost of the smallest is 3,000 francs, or £120 each, exclusive of a four-horse engine and boiler, the power required to drive them being about 1-horse power per candle.† The maximum distance from the machine at which the current can be advantageously transmitted is 800 yards; and it also transpired that all the candles upon the same circuit or machine are of uniform intensity, it having been found extremely difficult, if not impossible, to produce them of varying intensity from the same source.

Amongst others, the following places are lighted by the method above described:—

Place de l'Opera.
Avenue de l'Opera.
Place du Thèâtre Français.
Front of the Corps Législatif.
Place du l'Etoile.
Hotel du Louvre (Courtyard).
Magazin du Louvre (Interior).
" " (Front)
Orangerie (at corner of the Gardens of the Tuileries).
Hippodrome, and the
Workshops of the Electric Light Company.

Its effectiveness, as thus displayed in some of the most frequented parts of the city, with the brilliant appearance of which it is impossible not to be impressed, is beyond question; and goes far to prove its general adaptability for open air illumination, and for the lighting of large public buildings or workshops. The eye does not appear to experience any but the slightest sense of fatigue, the otherwise intolerable intensity of the light being almost entirely subdued, but there still remains an objection which is thought by some to have considerable force, namely, that it imparts to the countenance a somewhat unnatural hue. Its employment, however, at such places as the Magazin du Louvre, the Orangerie, and the Hippodrome, seems to show that whatever importance may attach to this objection, is outweighed by other considerations. At the Hippodrome, an immense oval building, 341 ft. long by 223 ft. wide, which is crowded nightly, an excellent effect is produced by 14 reflected electric lights, and 20 suspended "candles," the balconies and orchestra being in addition lighted with gas. When, during one portion of the performance, it was desired to darken the arena, this was readily effected by withdrawing the 14 reflected lights; and these, after a short interval, were again put forward without any apparent difficulty. At the nightly concerts at the Orangerie, the orchestra and stage are lighted entirely by electricity, as are also the long promenade and hall. The promenade is about 32 yards wide, and the candles are placed about 26 yards apart, so as to form one row down the centre. I was able to read a newspaper without the slightest difficulty at the furthest distance from any of the candles. It was here, however, that in the course of the evening I observed a considerable unsteadiness in the light, as though the engine power was not being properly maintained; and a disagreeable pink light was the result when, as happened several times, the candles were allowed to burn a little too long.

On the evening of the fête-day a very pleasing effect was produced by the simultaneous lighting of two long rows of candles, extending through the trees along the entire length of the Gardens of the Tuileries, suggesting a wish for the better success of the endeavors that have lately been made to light and extinguish our own gas lamps by the same agency. Except, however, for special objects, such as the illumination of fountains and cascades, gas is much to be preferred for the purposes of a general illumination, its superior divisibility rendering it peculiarly adapted for the production of artistic effect.

The prominent characteristic of the electric light is of course its concentration, but this, which probably constitutes is chief value as an outdoor illuminant, is a fatal obstacle in the way of its general adoption, and hence it is only natusal that its advocates should endeavor to overcome this by attempting a more minute subdivision of the electric current than has yet been achieved. We were shown, by M. Jablochkoff, at the Pavilion of the Electric Light Company, in the Exhibition, an arrangement by which he has succeeded in producing at will two ordinary or four smaller candles from the same source; but the cumbrous nature of the apparatus employed

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* See "Engineer," Dec. 21st, 1877. See "Engineering," July 26th, 1878.

† This is an under-estimate; for in every case, so far as we had opportunities for observing, a much greater power was employed. It would be safer to take it at two h.p. per candle.

precludes the possibility of its possessing any immediate practical value.

With regard to the question of comparative cost, it is clearly not necessary to invest the fact of the employment of the electric light in Paris, during this Exhibition period, with any special significance, since it may be fairly assumed that, under the circumstances, other considerations would be allowed to have at least equal weight; and the fact that, in the principal thoroughfaref lighted by this method, "Coal gas resumes its sway," as a recent writer to the *Times* expressed it, shortly after midnight, shows pretty clearly that the Municipality have not yet made up their minds to abandon its use. In the Avenue de l'Opera, and Place of that name, to which this observation more particularly applies, 180 ordinary gas lamps are every evening temporarily displaced by 30 electric candles, being in the proportion of one to six; and as the Municipality pay for the candles at the rate of 1 franc 25 centimes, or about 1s. per hour each, while gas for six burners would cost for the same period, at 7s. per 1,000 cubic feet, which is about the price of gas in Paris, a little less than 3d., it is apparent that the candles are a luxury in which it is quite possible too freely to indulge. It is, however, only right to state that the light given by them is much superior to that afforded by the gas lamps, used in the above proportion; but if the comparison be made upon equal terms, it will still be found to be very much in favor of gas. For instance, if we assume that the light given by one electric candle be twice as much as what I conceive to be a fair estimate, vix., 200 candles, then the comparison will be between the light of 400 candles distributed from one focus, and costing 1s. per hour, including attendance, wear and tear, and, it is to be presumed, promoter's profit —and 30 gas lamps, distributing their light, as a matter of course, over a far greater area. The latter would cost—

For gas, at 3s., 150 cu. ft. per hour	5·4d
To which add, for lighting, cleaning and extinguishing, say 20 per ct. or	1·08
Total	6·48

Or say 6½d., which, deducted from the 1s., as above, leaves a balance of 5½d. in favor of the gas, in addition to which there has to be taken into account the undoubted economy resulting from the far greater area which would be illuminated by the latter.

It will be apparent from the foregoing that, while the electric light possesses certain advantages which may procure for it a limited amount of favor for special purposes, these advantages are accompanied by such serious brawbacks as to render it unsuitable for general employment; so that although in some particulars, as in the cost of the "candle" proper, it would seem to be a matter of no great difficulty to effect improvements, suggesting the desirability of watchfulness over any progress that may be reported, there appear at present to be no grounds for believing that coal gas is likely to any extent to suffer from the rivalry with which it has for some time past been threatened.

CHARLES HUNT,
Engineer.

WINDSOR STREET,
Aug. 5th, 1878.

Since the above was written I have been favored with a sight of a copy of an estimate, given by M. Jablochkoff to the managers of a club house in Paris, for the supply of apparatus complete, including magneto-electric machine, five or six horse power engine and boiler, lanterns, wires, and every other requisite, fixed ready for use, the cost for four candles being 11,623 frs. 50 c., or nearly £465.

He further estimates the cost of maintaining the four lights, including the candles, attendance and fuel for engine, at 3 frs. 54 c. per hour, or 2s. 10½d. English.

Mr. Harbison—While upon the subject of electric light I will state that some of the members understood Mr. Nettleton to say that the light, as used by Mr. Wallace, was without a return wire. If he is here I would be glad if he would be kind enough to repeat his statement in that respect.

Mr. Nettleton—As I understood him, and I think I am correct, the wire is run from the machine around the shop, and back to the machine again. In that sense it is a return wire. But wherever he wishes to put in a light, or a candle, he cuts the wire and inserts the candle.

His machines are of different sizes. He has them from two lights each, up to eight lights, and, I think, twelve lights. But those candles are all on one wire; and, furthermore, he has it so arranged that he can put out one candle, and all the rest will remain just as well as if all were burning.

Mr. Harbison—In regard to the subject of testing the temperature of retorts; in addition to what Major Dresser said, allusion was made to the fact that some experiments had been made by Mr. Greenough, of Boston. Mr. Greenough gave us, at the New England meeting, a very interesting report of some experiments that he had made; and I think it will be of great interest to those gentlemen who were not in Boston if he will repeat that statement here, and give us the results of the experiments that he made in regard to the temperature of the retorts during the burning out of the charge.

Mr. Wood—Before we come to that I would like to inquire of Major Dresser one thing. If I understand him, he says that there are four or five candles placed in one lamp, and that these burn for five or six hours.

Major Dresser—Yes; burning one at a time. They burn one and then light another. They are not all lighted at once. Each one of these burns about an hour or an hour and a-quarter; and, as there are four of them, each lamp will last about five hours.

A member—Did you test the heat of the electric light?

Major Dresser—I will state that, so far as the lights in the Exposition were concerned, they were in such a shape that we could not get at that. But the Chartered Company, of London, have bought an electric machine, and a series of experiments are being made, by Mr. Sugg and Mr. Evans, to determine all these points. I was present with Mr. Sugg several times when experiments were being made, and we found that there was a great deal of heat in these lights. There must, of necessity, be a great deal of heat because it is this intensely heated carbon point that gives the light.

The President—Will Mr. M. S. Greenough explain his experiments in accordance with Mr. Harbison's request?

Mr. Greenough—I do not think there is the least difficulty in obtaining a tolerably accurate estimate of the heat of your retort. The method which we adopted in the experiments made in our works is the one that has been in use for many years in France, and, not only in France, but in various parts of the Continent, though not, I think, in England. It is simply an application of the principle of specific heat. It is, of course, known to every gentleman here that a given weight of one material will be more affected by a certain quantity of heat than an equal weight of another material. In the case before us, for example, if you take a certain weight of iron, say, five lbs., and leave it in the retort until it has been thoroughly heated, and then immerse that iron in a given weight of water, say, 40 lbs., the temperature of which has been previously taken, it is very easy to calculate what the temperature of the iron must have been when it was immersed, by noting the increased temperature of the water afterwards. You may not get, perhaps, within 50° of the temperature; but I have no hesitation in affirming my belief that, in the retorts I have experimented with, we have came as near as that. It is part of the ordinary operation of all our works, to thus test the temperature of any retort of the heat of which there is any question. I think gentlemen who have not made the experiment, and who are running charges, as they do in some works, of five or six hours duration, would be very much astonished to find how great is the reduction of temperature in the retort that actually takes place after the charge has been put in. It is very large, even for comparatively light four-hour charges. Take, for instance, an ordinary sized retort, and put into it a charge of 225 pounds of coal. The temperature of the retort before it was put in would be probably about 2300°; after the coal has been put in it will be some time before it is heated to a thousand degrees. At the end of an hour it will hardly get over 1400°. The heavier the charge put in, of course, the more the temperature will fall in the retort. If some ingenious plan could be devised similar in principle to Clegg's revolving web retort, by which only a small amount, say, 50 lbs. of coal, should be exposed to the action of the retort, at one time, we should all be surprised, I think, at the results obtained.

On motion, adjourned until ten o'clock to-morrow.

[To be continued.]

The Electric Light and Lighting by Electricity.

[From *Journal of Gas-Lighting.*]

A veteran in the art of gas making, and a scientific man as well, has favored us with his views on "The Electric Light and Lighting by Electricity." We publish the communication mainly to show how the matter is regarded by a gentleman with Mr. J. O. N. Rutter's interests and responsiblities. He has evidently no fear that the electric light will, for a very long time, come into serious competition with gas. What a distant future may bring forth no one can say. When coal becomes a scientific curiosity, the illimitable amount of electricity which may be developed with the assistance of mechanical force may be utilized to produce some of the effects now brought about by the combustion and distillation of coal. The sources of force are manifold, and the engineers of the "coming race" will find no difficulty in driving dynamo-electric machines without the aid of coal.

BY MR. J. O. N. RUTTER.

PART I.

What has been said of late about the electric light, some has been well said and some ill said. When so many opinions are expressed, it is not likely that all will be right; a great deal more is sure to follow. Respecting that, we must exercise patience. All is not projected that will have

to be realized. Nothing great, unexpected, and really valuable can be achieved without enthusiasm. When all has been done which can at present be done, there will be abundant opportunities, by efflux of time, for getting back to quietness.

Looking at electric lighting in its relations to gas lighting, I know of nothing to warrant the expectation that one will put out the light of the other. Nor will there be that kind of competition which is predicted. The electric light will have a special sphere for its operations, and, whilst doing a great deal in that sphere, is not likely to obtrude itself injuriously upon the already occupied sphere of gas light. Long, long ago I had no doubts that the electric would be *a* light, but not *the* light, of the future. When that would happen—the distance or nearness of the event—no one could guess. Changes, very wonderful changes, in the aspects of electric lighting are not only impending, but declaring their accomplishment; and their approach has been quicker than was generally anticipated. All this notwithstanding, and also the glib talk about the days of gas companies being numbered, there need be no fear that gas lighting will not hold on its way. In one sense its days are numbered; but the number is very great. Why do not the prophets quote the exact number?

There are many who are well skilled in gas making, and very many more connected with the sale and management of gas, who are not likely to be familiar with the phenomena of electricity. I have thought it might be desirable to try my hand, in a very plain way, at giving such persons a little information on the subject.

The question asked hundreds of times is, "What is the electric light?" Here is the old story—easy to ask questions, difficult to answer them. In this case the only plain and exact answer is, "The electric light is the electric light." So, again, another question might be asked: "What is electricity?" Can any other reply be given than that "Electricity is electricity?" No wonder if such replies appear to be curt and unsatisfactory.

Instead of asking "What is electricity?" suppose the question be, "Where is electricity?" So far as our knowledge extends, the answer to that is plain; for it is believed to be everywhere, and we are not able to think of any place within the boundaries of this world where it is not. Electricity is, by means of suitable instruments and apparatus, made to reveal itself as penetrating, or surrounding, or diffusing its marvellous properties in all kinds and forms of material substances, and in living organisms; and, whilst seeming to be an integral part thereof, it is in reality separate and distinct.

Frictional, or, as sometimes called, common electricity, is that produced—and yet not produced, but only accumulated and made apparent to the senses—by an electrical machine, emitting sparks, and, when a Leyden jar or battery is used, a powerful shock and brilliant sparkles of light. This kind of electricity all persons may be supposed to know something about. It is the same as lightning, which precedes thunder.

Galvanic or voltaic electricty depends upon chemical action, by dissimilar metals, mineral acids, and many other kinds of materials which are used in the departments of telegraphy. By these means a brilliant light can be obtained; but not sufficiently steady and constinuous for lighting purposes.

Electro-magnetic electricity—what does that mean? Making a bar of iron into a temporary magnet, possessing all the properties of a steel magnet. This is done by putting a voltaic current along a coil of copper wire, within which is placed a bar or horseshoe-shaped piece of soft (malleable) iron. So long as the current is passing, the magnetic properties continue. When it ceases, what was a magnet becomes again a piece of inert iron.

What might not improperly be called vital electricity is that which is known to influence, and is associated with, the bodily functions. It is wrong to say that life is electricity, and equally wrong to say that electricity is life. It is not possible to believe that life can be sustained without it; but how it operates and what are its conditions as respects strength and weakness, health and disease, it is best to confess ignorance. Nothing is more certain than that what is called common electricity is emitted by the human body, and so also that which exactly resembles the voltaic current is set in motion, its effects made visible, and its force measured by the voluntary tension of certain nerves and muscles.

Much as is known of electricity, there are some outlying districts which have to be explored. Judging by the knowledge and experience already acquired, it is certain there is more to know and more to do. Never, for practical purposes, was such knowledge, and its right application, more urgently needed than at the present time.

We know that electricity is inseparably connected with heat, with light, with air, and all aëriform bodies (gases); that it is present in vapors, in liquids, in all solid substances with which we are acquainted, and, as there is reason to believe, in everything which has life, from the tiniest insect to the largest animal. Whether it is diffused through illimitable space or only a few miles above us, whether it penetrates through and through the globe or only a few miles or thousands of yards below its surface, are matters which may be thought about; but to such inquiries we get no response. But although within the range of our observations it is thus universally diffused, it is under the control of laws. By a knowledge of some of these laws it has been subjected to management; and so it is sent on a journey of thousands of miles to convey a message, and when, by powerful machinery, forced to pass in great quantities and very quickly through a few yards of wire, it changes darkness into what is very like daylight.

In a few words I must refer to some of the laws of electrical phenomena. It will pass freely, and, so to speak, instantly, along or through (we are not sure which it is) all kinds of metals, some more readily than others; but it will not do so with (dry) wood, with glass, or silk, or resinous substances. The substances by which it has a free passage are called conductors, the others non-conductors. An intermediate class are said to be imperfect conductors. Air is comparatively a good non-conductor when dry, very imperfect when moist. So also gas loses much of its non-conducting properties when covered with moisture. Water is a conductor, and so is steam. When two substances are so placed—one a conductor, the other a non-conductor—that the latter be a protection to the other, the conductor is said to be insulated; the object being the prevention of the escape of the electricity with which it is charged. For this reason the wires used in telegraphy and other electrical operations are covered with non-conducting substances.

There is another law. It is invariable and unalterable, and not affected by any external influences. This relates to opposite states or different properties of electricity. They are called positive and negative; but they are names only. Upon the relations subsisting between different qualities or different conditions, whatever they may be, and the effects produced by their separation and coalition, all the phenomena of electricity, as at present known, may be supposed to depend.

Turning back to the description given of electro-magnetic electricity, it will be seen that by passing a current along a coil of copper wire, which surrounds a piece of soft iron, the iron immediately becomes endowed with the properties of a properly-made steel magnet, permanency excepted. On stopping the flow of electricity, the so-called magnet becomes what it was before.

It is not necessary to describe the properties of permanent magnets, nor the way by which their properties of attraction, repulsion, and polar direction are imparted. We know it is done: and if it be asked why steel retains magnetism and iron does not, the only answer is "Don't know." The fact is known and it is a very old fact—especially polarity, as in the mariner's compass. This was practically known many hundreds, and probably thousands, of years before the affinities between magnetism and electricity were discovered.

Now we must think of other forms of apparatus in which a voltaic current is not employed. Instead of making soft iron enclosed within a coil (helix) of covered wire into a magnet in that way, the arrangements are reversed. Here the work before assigned to the voltaic battery is done by the magnet; the soft iron and its appendages being set rotating in front, at the sides, or between the poles of the magnets. The magnets are stationary, and the rotating iron is converted into an electro-magnet. This is called magneto-electricity. By its means the electric light, as well as the other phenomena of electricity, are elicited. Here the aid of another power has to be engaged—mechanical force, a steam-engine being the motor.

At Florence, in 1832, the discovery was first made that a spark—the electric light in miniature—could be obtained from a natural magnet (loadstone). This soon led to other methods of manipulation and forms of apparatus. In 1833 the spark was shown in this country. This was done by operating with steel magnets and a rotating (soft iron) electro-magnet, the spark being emitted at every break of the circuit. By that machine, which a child could set in motion, a spark, a shock, and the decomposition of water were obtained, and (by induction) another electro-magnet. Since the first recognition of this new phase of electrical science (46 years), there have been improvements in apparatus, or rather in magneto-electric machines, some of which are so large and costly, that it sets us thinking about difficulties and failures in proof that the interval has been so great between discovery and practical application. Discouragement does not mean defeat. There now appears to be a sudded awakening. New ideas, new forms of manipulation, more powerful machines, and the correctives by knowledge and experiences already acquired, are more likely to be successes than failures. If magneto-electricity be capable of yielding a steady, continuous, pleasant, and not too costly a light, it will do it. It is beyond doubt that means will be devised for such a distribution as shall adapt it specially for special localities and purposes. What there may be beyond and in addition we can wait for patiently.

What about the motions of the machines employed in magneto-electricity? To fit them for their work they must be made of the best materials, and constructed with such skill as to be as nearly as possible perfect. When we think of the rapidity with which the electro-magnetic portion of the machines revolves, it seems to take one's breath away. Eight hundred revolutions in a minute—13 times during each beat of a seconds pendulum—is not an extraordinary rate of speed. There are smaller machines which have revolved at the rate of 1100 times in a minute.

Of electricity, whatever its properties, or the names by which it is designated, it must be said that it is not made—not produced. It already exists; and so

there can be said of it what is not to be said of any other light-producing materials at present known—that the supply is inexhaustible. For candles, for lamps, for gas, the materials employed in producing light are not replaced and not recoverable. As respects coal especially, it is well-known that the place is not re-occupied by the same kind of material. Not so with electricity. Use as much of it as we may, there is no waste, no loss, no deterioration—as much remains after we have done as before we began. Whatever kind of work it is set to do, if our part be properly done, electricity will do its part well. The world is full of it. Only the proper appliances and good management are required, and it will

"Put a girdle round about the earth in forty minutes,"

and when that is done it is neither wearied nor is it unwilling to do the same again, or something equally or more difficult.

How is light obtained by electricity? By powerful machinery, as already mentioned, it is gathered and dispersed. By thus gathering and dispersing great quantities, and compelling it, during the process, to leap across a very narrow space between the conductors where carbon points are fixed, it makes itself visible, and more or less brilliantly in proportion to the quantities and attendant conditions.

The light can be obtained. No one doubts that. The need now is to get it under control; to subdue and to modify its extreme intensity, and so to regulate it as that it may do what we require without waste. We want to make it not only to subserve our conveniences, but to be a pleasant companion, quiet, steady, manageable. Lighting by electricity must be next thought about.

Black Rock, Brighton, Oct. 30, 1878.

The Electric Light at Sea.

The following interesting letter, says the *Telegraphic Journal*, has been received by Messrs. Siemens Brothers:

S. S. *Faraday*, London, Aug. 11, 1878.

DEAR SIRS—During our last voyage homeward from New York we had a proof of the utility of the electric light on board ship.

On the night of the 18th July, near the Georges Bank, we narrowly escaped collission with a large full-rigged ship, under the following circumstances:

About 10:30 P.M., wind fresh from westward, fog very dense. Suddenly we heard the sound of a bell ringing furiously, at a short distance nearly ahead. We immediately stopped our engines, and supposing it to be a fisherman at anchor, or almost stationary, I ordered the wheel to be ported; at the same moment the electric light pierced the fog, and plainly showed the head sails of a ship heading to the southward, and crossing the bow. Not a moment to be lost, we shifted the wheel to starboard, put the port engines full speed astern, and starboard engines full speed ahead, and cleared her by a few feet only. Our look-out men say they could have stepped on her stern.

She appeared to be full of passengers, and the cries women and children were heartrending. I never shall forget it. I hailed them several times, telling them they were safe; but it was no easy matter to get them to realize it, seeing death, as it were, staring them in the face.

Of course, they could see nothing but our powerful light, whereas we could plainly see people and everything on board the other ship. Had I not been able to see her so plainly, and the way she was going, we must have gone over her, or she might have struck us on the port bow; in either case the loss of life must have been great, and even now it seems terrible to contemplate.

In this particular case we are more than a thousand times compensated for the trouble and expense in fitting our electric light, and I wish all other steamship owners would adopt it as a means of safety in navigation, for I believe, when the reflectors are properly adjusted, that the land as well as ships may be seen on a dark night in time to avoid danger.

I am, dear sirs, yours faithfully,

(Signed) SAM. TROTT.

Edison's Lamp.

It is somewhat remarkable that, although gas shares depreciated greatly and suddenly in England on the announcement that Mr. Edison had affected a startling improvement in electric lighting, few persons in that country had the slightest idea of what the alleged improvement consisted. Leaving out of consideration the practicability of the infinite subdivision of the current regarding which scientific electricians have well-known views that are not likely to be much affected now, we come to the principal part of the invention. More than a quarter of a century ago a good deal was done by inventors in this and other countries toward securing an electric light by causing a current to pass through a platinum wire, and so raising its temperature as to make it self-luminous. The results fell far short of the expectations of the sanguine experimenters. One obstacle to success was the liability of the wire to fuse. This obstacle Mr. Edison now claims to have overcome by so applying a small bar that it will expand the instant the wire reaches the fusing point and intercept the flow of the current through the wire sufficiently to prevent fusing.

Actual trial must determine whether the action of this automatic bar regulator will secure a steady light. It would hardly be just to criticise minutely all that Mr. Edison is reported to have said about this and other inventions of his. But enough has been indicated to show that illuminating gas can be manufactured profitably yet, notwitstanding all that has been done in electric lighting. A few evening's study of any good text-book on electricity and its applications would enable holders of gas stock and other enthusiastic persons to possess their souls in patience, and give them a knowledge of facts which will induce a little wholesome scepticism.—*N. Y. Times.*

The Electric Light.

The following article, from the pen of an able professor in one of the Metropolitan Hospitals, appeared in the *Lancet* of Oct. 26:

The world is waiting, with very natural impatience, for Mr. Edison's invention, which we are assured is to revolutionize lighting, warming, and cooking at a touch. The form in which his preliminary notice has been presented.—the somewhat theatrical *avant-courcur* which he has despatched—is not calculated to inspire blind confidence; but, on the other hand, his brilliant successes in acoustics, and his known skill and energy, forbid total unbelief, and compel us for the present to suspend our judgment.

The problem to be solved may be simply stated as follows:

It is admitted that the light of the electric arc is whiter than any other; that it avoids pernicious products of combustion; and that, light, for light, it is cheaper than coal gas. Every property of solar is possessed by electric light, and the latter may even be made to compete in intensity with the former. Its power of penetration is enormous, and for certain purposes, such as the illumination of lighthouses, men-of-war, and public places and buildings, its suitability is denied by none. But, on the other hand, the disadvantages of the light, as now applied, are equally evident. It is at once dazzling and unsteady; it blinds one moment and is gone the next. It requires a complex and expensive machine at every light—a machine liable to derangement, and useless if deranged; and, if the lights are arranged in a circuit, the interruption of one involves the interruption of all.

These defects are due, firstly, to the fact that the light is only obtained in full brilliancy between carbon points which must be kept at a fixed distance apart, although the points themselves are constantly varying in length; and, secondly, to the difficulty—or, rather, at present, impossibility—of obtaining diffused light from so small and so intensely brilliant a centre.

Various contrivances have been adopted to overcome the first of these objections, but none hitherto have been perfect, because it is only when the current begins to slacken, and the light thereby to fall off, that the compensating machinery can act. For a similar reason, all attempts to subdivide the light, so that a single current should yield light, as gas does, at many distant points, have hitherto met with very imperfect success. It is hard enough to keep the light constant at one point, but to keep it constant simultaneously at many points, when a failure at one would induce total darkness at all, is at present impossible. When it is added that the electrical resistance at every light is very great, and that the "lighting of the gas" in any one house would suddenly introduce a great additional resistance in the circuit, the difficulties of the problem will be appreciated.

These, then, are some of the difficulties which Mr. Edison professes to have overcome. It is useless to speculate when the facts will so soon be revealed. It is, of course, possible that the ingenious American may, to use the words of a scientific contemporary, have "turned the flank of the difficulty," by avoiding the use of carbon altogether, although, even then, it is hard to understand how uniform light, at a constantly varying number of centres, can be obtained. We by no means deny the possibility, but simply leave it to time and Mr. Edison to prove it.

One consideration of especial interest for our readers remains—namely, the effect, good or evil, of intense light on the organs of vision. A very interesting discussion of this question will be found in Mr. Proust's "Traité d'Hygiène Publique et Privée," recently reviewed in these columns. Without indorsing all the author's views, we find in many of his arguments serious matter for thought, and even fear that the future may confirm, in regard to its effects on eyesight, his condemnation of "*cet eclairage profondement dangereux.*"—*Journal of Gas-Lighting.*

The Electric Light and the Gas Panic.

[From the *British Mail.*]

For the last ten years at least the electric light has been more or less before the public. At first it was looked upon merely as an aid to scientific research, especially in connection with the spectroscope; but it was not long before its value as an illuminating agent was recognized, and recommendations for its employmployment in lighthouses were effectually made. Although its history is so recent it is not easy to ascertain when, how, or by whom the idea was first started, or to trace the steps by which it has reached its present stage of successful application. Its progress, although rapid, has been gradual, and yet people talk of it as a revelation of yesterday. Those who are best acquainted with its capabilities, know also that the difficulties in the way of its general use are very great, and that with every fresh improvement new obstacles present themselves. If we are to believe the reports of inspired inventors and their credulous admirers, every difficulty has been surmounted, but we have heard so many jubilations of a similar kiad in connection with almost every branch of discovery, that prudent people prefer to wait for realized demonstrations. But the majority of people are not prudent, and the inflated reports of Mr. Edison's invention—which, by the way, is only promised—have acted on the holders of shares in gas companies much in the same way as a cry of "fire!" does upon the audience in a theatre, making them lose their presence of mind. While we admire Mr. Edison's cleverness, we should not forget that he has not acquired any reputation for reliability. Those who are acquainted with the gossip of the scientific

world know that Mr. Edison has got into very bad repute by the way in which he brought charges of plagiarism, breach of faith, and general rascality against eminent men who were altogether guiltless of any knowledge of his sayings or doings. He has a great deal of "gas" in his composition, and sometimes indulges in gasconade. Still he is clever, and has a fair knowledge of electrical science. He has, it is said, been the author of scores of inventions, and he has struck the right nail on the head more than once. Of course he may have done so again, but the odds are against him. It is a way he has to announce his inventions as completed when they are only commenced. He affects a great fear of having his ideas pirated, and yet he cannot keep his own counsel till he is secure. Already a great many guesses have been made as to the nature of his invention, and as he does not possess a monopoly of cleverness he may find himself to be forestalled. Others have been at work on the same problem, and they had even achieved success before he took it up. Dr. Siemens and his brother have done good work towards the utilization and division of the electric light; so far back as 1867, they freely communicated their ideas to some of our learned societies, and M. Jablochkoff has done the same in France, so that Mr. Edison must be very careful lest the charge of plagiarism should recoil upon himself.

The success of the electric light does not, however, depend altogether upon the realization of Mr. Edison's promises. Several other inventors have brought it under practical subjection so as to make it a formidable rival to gas in the lighting of large areas. It is indeed in extensive use in France, Belgium and elsewhere; but it does not follow that its employment in England will be equally beneficial, for the very sufficient reason that gas is much cheaper here than on the Continent. There is a great discrepancy in the various estimates of the relative cheapness of the competing lights, many of them being based on mere theory. Perhaps the most reliable of the witnesses is M. Jablochkoff, who tells us that in the Louvre where the light has been in use for a year, the proprietors of the *magasins* have proved a saving of 30 per cent. But taking into account the relative price of gas in Paris and in London, it may be found that the 30 per cent. should here be placed on the other side of the account. We all know that gas is not so cheap as it ought to be; that the companies take care to have large profits; and we may safely assume that those who supply us with the electric light will not be satisfied with less. Heretofore they have acted wisely in dealing with extreme liberality towards those who introduce the light. Upon the whole we may reasonably expect that for illuminating large spaces, railway stations, workshops, and warehouses, the new light will be found to be cheaper than the old, but the case is by no means clear, and it is too soon to go into rhapsodies about the unachieved result. The decision of the Metropolitan Board of Works to light up the Thames Embankment with electricity will be the best practical test of its value and of the cost of its substitution for gas.

The best proof of the extent to which the electric light is already employed is to be found in the fact that M. Jablochkoff is now manufacturing his candles at the rate of from 3,000 to 5,000 per day. The cost of the light, in candles alone, is only one-eighth of the expense of an equivalent illumination by gas, but the inventor himself modestly says, "I should never dare to represent my figures as realisable in practice." This is the right spirit in which an inventor should speak of his work. Mr. Edison is not of so retiring a disposition, for he speaks as if the light is cheapened by the additional appliances for its subdivision. But this is a case in which the economical argument may be pushed too far. If, as is evident, the light is far superior in many respects to gas, it should be adopted even if the expense be greater.

The coming invention promises not only to supply us with light at a merely nominal charge, but to supply heat for cooking and power to drive sewing machines, and to do other household work equally cheap. The promise as to light may be kept, but we utterly refuse to believe the flattering tale about the heat and the power. We know that the electro-dynamic machine, which is to be the prime motor of all these wonders, is to be driven by steam engendered by heat produced in the ordinary way, and we know enough of the properties of heat and its equivalent in work to be sure that the effect cannot be greater than the cause. The best electro-dynamic machine that ever was made does not reproduce more than 80 per cent. of the power used to work it, even in direct application. What percentage would remain after the current has been carried to a distance and be subdivided must be left to the imagination. The loss of transmission for a distance of 200 yards has been estimated at 40 per cent., and it has been said by eminent engineers that to provide for the lighting of a town by electricity it will be requisite to have steam engines not more than 500 yards apart. It cannot be expected that the heat and the power would fare any better than the light, if so well. There has been a great deal of wild talk about pressing waterfalls into our service for the production of electro-dynamic power, but it has not been found in practice that water as a prime-motor is cheaper than steam, except under favorable circumstances. Those who talk about putting the Falls of Niagara into harness should tell us something about the size of the turbine through which the torrent is to be passed, for there must be some intermediate contrivance between the Falls and the electro-dynamic apparatus.

A good cause is always injured by the extravagance of those who are its advocates; and the electric light has so established its claims to have a fair trial that it is a pity that discredit should be thrown upon it by those who raise expectations which can never be fully realized. It will make its way slowly but surely into public favor; but to suppose that it will extinguish all other modes of illumination is absurd. Gas did not put lamps and candles altogether out of fashion, and for some purposes even the farthing rushlight may still have its uses. Let the electric light be all that fancy paints it, we shall not have to give up one of our old familiar friends. We had better wait patiently for the result of the trial by the Board of Works, although we would have been much better pleased if that body had not accepted the offer of the Société Générale de l'Electricité to give the use of their machinery for nothing, for such a transaction introduces an element of uncertainty into the calculations of cost. The Board deserves credit, however, for resolving not to wait for the promised improvements of anybody, for if they acted on such a principle they would never be able to make a beginning. It is time that London should test the value of the light, for even the Russian Government has determined that St. Petersburg shall be lighted on Jablochkoff's system.

Impure Gas.

To the Editor of the New York Times:

Within the past few days I have noticed through the columns of your journal several deaths resulting from the inhalation of gas. Feeling a deep interest in these cases, as in all others appertaining to the public health, I have followed them up and discovered the following facts. One of the cases was that of a stranger in the city who, upon retiring to his room in the St. Charles Hotel, in Broadway, blew out the gas and went to bed. His groans soon attracted attention, and, when found, his shirt-front and bedclothing were covered with blood, thus indicating that the gas inhaled must have been of a most poisonous nature. The man was taken to a hospital in an insensible condition, and died soon after. Upon inquiry made at the hotel great reticence regarding the cause of his death was manifested.

Another case was that of a man and woman who took a room at No. 31 Bowery, where the gas was also blown out. When discovered the man was dead and the woman was taken to the hospital insensible, where, I learn, she has since died. The indications here, also, were such as to prove poison in the manufacture of the gas inhaled. The gas used in both the above places is from the same manufactory.

These three deaths occurring in so brief a period, and from the same cause, would seem to demand a most stringent investigation, but I have yet to learn that the Board of Health, or any other brach of the Municipal Government has as yet instituted such an inquiry as ought to be made. Have the public authorities no control over the gas companies, or are they privileged to furnish any quality of gas they please, at the lowest possible cost to themselves, without regard to the health or lives of citizens who are obliged to consume it?

I find in the printed form in the contract made between the Department of Public Works and such gas companies as are employed to light the street lamps the following relating to the illuminating materials to be used, quality, etc.: "As regards purity, free, within limits not injurious to public health, from ammonia, sulphuretted hydrogen, and other sulphur or noxious compounds." This is a special clause as far as the general public on the streets is concerned. Now, why should not the Board of Health be equally vigilant and as careful to protect the inhabitants of the houses of New York, guests of the various hotels, and visitors to places of public amusement, by making a rigid examination into the manufacture of gas by all the companies in the city, and if it should be found that any process used is such that, in case of accident by the escape of gas, poisonous vapors are generated that, if inhaled, certain and almost instantaneous death must ensue, close such establishment and forbid the further manufacture of such deadly poison. Shall we wait until some terrible calamity, owing to imperfect gas-fitting, the breakage of a main, or some carelessness, forces this matter upon public attention, or shall an investigation be ordered at once, on the principle that an ounce of prevention is worth a pound of cure.

PRO BONO PUBLICO.

NEW YORK, Friday, Nov. 15, 1878.

No Gas in Spain.—Lorenzo Munzo Lacerna, aged 17, an employe of the Spanish Government, arrived in New York from Malaga, on Nov. 16, in the steamship Crux. He took board in the Hotel Español, at No. 21 East Fourth street. When he went to bed at 10 o'clock, he blew out the gas. He was found dead in his room the next afternoon, having been suffocated.—*Ibid.*

Absorption of Carbonic Oxide by Living Organisms.—N. Gréhant has experimented with mixtures of air and minute portions of carbonic oxide. He finds that a man or an animal, when compelled for half an hour to breathe an atmosphere containing only 1-779 of carbonic oxide, absorbs that gas in sufficient quantities to saturate about half of the red globules of the blood, so that they become incapable of absorbing oxygen. In an atmosphere containing 1-1449 of carbonic oxide, about a quarter of the red globules are similarly saturated. These results are interesting and important in relation to physiology and hygiene.—*Comptes Rendus.*

Lighting a Foundry by Electricity.—A trial of the electric light for illuminating the shell foundry in the Royal Laboratory Department of the Royal Arsenal, Woolwich, is ordered to be made, and an apparatus is being fitted up for the purpose by the Royal Engineers. Since the application of the electric lamp to naval purposes a large assortment of the requisite materials have accumulated in store, and if the experiment is found to succeed in the shell foundry, which is a spacious workshop, the new illuminating power will be applied to other parts of the Royal Arsenal to which it may be adapted.—*Iron.*

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,

PROPRIETORS.

Editor—G. WARREN DRESSER.

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AGENTS

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PHILADELPHIA—PRATT & Co., Corner 5th and Arch Streets.
Germany—B. WESTERMANN & Co., of New York.

MONDAY, DECEMBER 2, 1878.

Official Report of Examinations of Gas for two Weeks ending Nov. 23, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Nov. 1788.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
11	Between 9.30 A.M. and 1 P.M.	17.08	17.27	20.00	16.95	16.79	
12		16.65	17.22	19.26	16.85	16.43	
13		14.68	16.49	18.74	16.52	16.13	
14		15.92	17.08	18.84	16.67	16.32	
15		14.75	17.42	18.83	16.72	16.28	
16		17.35	17.96	20.06	16.44	16.13	
	Average	16.07	17.24	19.29	16.69	16.34	
18		17.09	17.56	18.67	16.30	16.04	
19		15.47	17.66	18.54	16.46	16.23	
20		16.64	17.38	18.99	16.53	16.18	
21		16.74	17.25	18.68	17.32	16.58	
22		16.00	15.54	18.21	17.11	16.52	
23		16.17	16.52	18.87	17.26	16.29	
	Average	16.35	16.98	18.81	16.83	16.30	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

It is now generally urged in extenuation of Ananias's offence that he was raised with no other playmates than a couple of gas meters.—*Burlington Hawk-eye.*

A Casual Correspondent of an exchange has been experimenting with the "fiat" theory and can't make it work. He appended to a gas-burner the words "fiat lux," but got no light; he also returned to the gas company their bill, indorsed "this is paid," but the agent came into his house and carried of the meter.

Correspondence

[We are not responsible for the opinions expressed by Correspondents. Correspondents, in all cases, should sign their communications with their names and address in full—not for publiction, unless desired, but as a guarantee of good faith.—ED.]

[Special Correspondence of the AMER. GAS-LIGHT JOURNAL.]

Gas Notes From Ohio.

COLUMBUS, O., NOV. 23, 1878.

Zanesville, one of the smoky cities of Ohio, is supplied with gas at the rate of $2 per thousand.

Some people think that the only way to allay the "gas war" is to pour oil upon the troubled meters.

This city (Columbus, O.,) owes its gas company about $30,000. The gas company seems to survive, however.

Quite a number of the Western cities are quareling with their gas companies, and a number of the citizens are burning coal oil. We congratulate the coroners upon their prospects of increased fees.

The cry against the gas companies these many years has always been that the light is often poor and the charges always high. Now is the time for the manufacturers to put their heads together and go down in the prices and up in the quality.

Washington Court House is the name of a thriving town in this State that manages to support a gas company with only 150 consumers. The Common Council of Washington Court House regulates the price of gas to these 150 consumers, which is now fixed at $3 per thousand feet.

For a year past the City Council and the gas company of Akron, O., have been wrangling and quarreling about the public lamps. Last week the trouble arose to fever-heat, and culminated in the removal by the city of 229 lamps, leaving the place almost in total darkness, and nobody benefited.

The town of Upper Sandusky, O., will no longer grope in darkness. Mr. James M. Hawes, and other enterprising citizens of that flourishing town, have filed in the office of the Secretary of State, in this city, papers of incorporation of the Upper Sandusky Gas-Light Company. The capital stock is $25,000, in shares of $50.

The intelligent and gasy editors of some of the Cincinnati papers claim that the gas in the gasometer ready for use costs exactly 28 cents per thousand in that city. What the intelligent editor of a newspaper don't know about the cost of manufacturing gas can not possibly be of any use to the numerous competent gas manufacturers of this land of "free speech and free thought."

Notwithstanding the hue and cry about the electric light and the numerous predictions that coal gas as an illuminator has seen its best days, and will soon be a thing of the past, it is a fact that throughout the entire west, in the small towns, more gas works are being erected and gas companies being organized, than has ever before been known in the history of the western country.

Mr. A. D. Perry, who for many years has been the efficient superintendent of the gas company at Mansfield, O., has resigned his position to accept the superintendency of the gas works at Rochester, N. Y. Mr. Perry has already gone to his new field of labor. The gentleman has many friends in Mansfield, and will be greatly missed in that city. His management of the Mansfiele gas works has been emintntly satisfactory, and under his supervision they have become among the best in Ohio.

It is said that the Parisian ladies denounce the electric light because it makes a rosy complexion appear deathly white, and changes the white to a glarish yellow. This probably will not cause the inventors of the new light to commit suicide, yet women rule that portion of the world called the social circle; they are its queens, and if they decide against the light for use in the parlor, the drawing-room, and the home circle, neither the great genius of the inventors the wonderful wealth of their "backers" can overcome the fiat of the fair ones.

In Salem, O., the price of gas has been reduced from $2.75 to $2.40 per 1,000 cubic feet. This gives Salem gas-light at lower rates, it is claimed, than any other town of equal population or consumption in the State. The gas company of Salem has produced figures to show that the cost of manufacturing and distributing their gas is about $2 per thousand. They claim that if the consumption were doubled they could afford to make a further reduction. In Salem harmony and a good feeling exist between the people and the gas company. As this state of affairs does not probably exist in any other town or city in the world let it be recorded to Salem's credit in g-r-e-a-t big letters.

The panic about Edison and his improvements in the electric light struck Cincinnati as well as other western cities, and ran the stock of the Cincinnati Gas-Light and Coke Company down to 130. However, the stockholders didn't scare worth a cent, and but very few shares were offered. Now there is more of the stock in the market, and on Thursday last the stock went up $5 a share. It is very firm, and will probably go to 150 again. The dividends paid by the company are the same they have paid for fifteen years, and its business and affairs, under the efficient management of its president, Gen. A. Hickenlooper, were never more prosperous than now. New lamps continue to be erected in the city of Cincinnati, and the list of consumers is again on the increase.

I wrote you in a former letter, some time ago, of the trial and acquital of Mr. John S. Cain, ex-secretary of the Louisville Gas Company, on the charge of embezzlement from the company. Mr. C. T. Vennigerholz, the present cashier of the company, was the principal prosecuting witness against Mr. Cain. And now Mr. John S. proposes to "raise Cain" with Mr. Vennigerholz, having had the latter gentleman indicted by the Grand Jury for perjury—accusing him of falsly swearing that certain entries on the books of the gas company were in Cain's handwriting. The defendant pleads "not guilty," and expresses himself as anxious for an early trial. The case is set for January 9, 1879, and the principal witnesses are John S. Cain, Mr. W. P. Lee, and Mr. Bart Jenkins. The two last named are at present employees of the gas company.

Mr. Henry D. Meek, of Bellair, O., now a "Justice of Peace," but recently the secretary and superintendent of the Bellair Gas Co., has got himself into a nice pickle. For some reason not explained to your correspondent, Mr. Meek lost his place with the gas company. An examination of his books after he left the employ of the gas company revealed the fact that Mr. Meek had cut out and destroyed 104 pages of the cash book and about 150 pages of the ledger—this being done by the gentleman to cover up his delinquencies and false entries. In addition to this, the officers of the company charge the Meek gentleman with having set fire to their books, with the intent of destroying them. The ex-secretary left Bellair after

severing his connection with the gas company, and went to Wheeling, W. Va., in which city he was arrested last week upon the charges above mentioned. He was arrained before Mayor Cassell, of Wheeling, and bound over for an appearance. But as soon as the fellow was released he "skedadled" for parts unknown, and it is now found that the gas company is short about $20,000 by the scoundrel, and haven't even the satisfaction of punishing the man. Mr. Henry D. Meek was a candidate for sheriff in Belmont county, O., at the time his little frailties were discovered; had always stood well in society, and, being a prominent man in the church, had, like many another man has done and is doing to-day, covered up a multitude of sins with a very large cloak of piety.

The City Council of this place (Columbus, O.,) have asked the gas company to light the public lamps for $14 per lamp, the price now paid being $20. The gas company, willing to do what is fair and right, decline the offer of $14, but agree to light the streets for $16 a lamp, a reduction of $4, which, to reasonable people hereabout, seems fair. The honorable members of Common Council (to speak in the vernacular) got right up on their municipal ear over the proposal of the gas company, and declared they would abolish gas in the public lamps and use coal oil. Therefore the Committee on Light, being duly authorized, advertised for bids for lighting the city with oil, and were exceedingly amazed, upon opening the bids, to find that the lowest was only $13.95 per post. The highest bid was $18. The honorable committee say they thought coal oil lighting would cost only about $10 or $11. So now they are in a state of disgust with the coal oil men, too. The troubles of our gas company are not alone with the Common Council, as quite an extensive movement is on foot among the business men toward asking for a reduction in the price of gas to private consumers, which, if not granted, the merchants say, will cause them to use coal oil. A great many are using oil now. UBIQUITY.

Coke in Cleveland.

CLEVELAND, O., Nov. 15, 1878.

Mr. Editor:—In looking over the proceedings of the American Gas-Light Association, as reported in the JOUARNAL of Nov. 2, I notice some discussion upon the question, "How to make good coke." From remarks made by Mr. Price, president of the Cleveland Gas-Light and Coke Company, I quote as follows:

"But just across the river from us, not more than a hundred yards distant, where they were using a different kind of coal, there was a good deal of complaint about the coke they made, and the people who naturally would have bought coke from them came to us; and when we asked them why they came to us to buy their coke, they said it was partly because they used poor coal—at any rate, inferior coal—and partly for another reason, which may hold good in other works besides those I refer to, and that is this: the works were small, and the men who had charge of the coke, and threw it out, went back to fill the retorts. The works were not large enough to employ sufficient labor, so that a number of men could be filling the retorts while the others were taking care of the coke. The result was that the coke was neglected, and was left to take care of itelf, while the men were filling the retorts with coal, and consequently it was often burned."

Ordinarily I should not deem it worth while to notice these remarks, but in these days, when the public are so alive to all that pertains to the products that gas-light companies furnish, I think it proper for me, as president of the company that must be referred to above, to offer through your columns a few words tending to correct a false impression, to the disadvantage of this company, that might obtain in the minds of many from reading the above criticism.

Of course I do not think Mr. Price intended to misrepresent facts, but he has evidently, in some way, obtained an incorrect impression of them himself. Our company has been furnishing gas in this city, on the west side of the river, nearly twelve years, and for the past ten years made it of Youghiogheny coal—either the New York and Cleveland Coal Company's Oak Hill, so called, (the same as has been used at Mr. Price's works for many years) or the Du Quense, so called, from a mine in the same vein as, and a coal precisely similar to, the former. The destruction of books and papers by fire, when our office was burned, a few years since, renders it impossible for me to state just what coals, or for how long a time they were used, during the first two years of the company's existence; but from memory I should say about equally of Beaver and Youghiogheny. We have enriched with cannel, carbonized in retorts by itself, and the coke from each kind of coal sold separately—the Cannel at half the price of the Youghiogheny. And every year that we have been doing business, the demand for coke with us has been largely in excess of our ability to supply; and for that reason we have often sent people to the east side works (Mr. Price's) for coke.

Perhaps some of them assigned the reason given by Mr. Price for going there. On the other hand, very many of our best customers come from the east side, when, according to Mr. Price, they would naturally buy coke at his office. It had not occurred to us, however, that the patronage of these people might be due to the poor quality of the coke made at his works.

Now about the quality of the coke being depreciated by neglecting to quench it immediately on withdrawal from the retorts. Possibly it might not be improved, but I think the loss in quantity would be much greater than in quality; and such a practice is the more to be guarded against on that account. As to the distribution of labor in our works, there has never been a time in its history when there was not sufficient help provided to quench the coke at the earliest moment.

I can only account for Mr. Price's impression on this point as resulting either from an imagination of what might possibly be the case, owning to the small size of the works, or a chance exceptional observation on his part, which did not at all represent the usual practice.

Mr. Price also remarks, in connection with the quotation above made, that there is a great deal of coal used that is utterly unfit for gas purposes, and gives as reasons for such use the following: "Because it is very cheap; sometimes the stockholders of the gas companies are interested in the coal companies that sell this cheap coal, or in the railroad that carries it."

Now the gentleman may not have referred to this company in these latter or former remarks, as he made them, but the connection is such that the inference that he did seems natural to make. I have only to say that, so far as I know (and I believe I am well informed), no stockholder or director is now or ever has been interested in the company that mined, or the railroad that carried, any coal ever used by this company for making gas.

Trusting you may be willing to give this communication a place in the columns of the next issue of the JOURNAL, I am yours truly,

GEO. W. WARMINGTON,
President.

Electric Light in Philadelphia.

PHILADELPHIA, Nov. 15, 1878.

Mr. Editor:—It is a little refreshing in times like these, when the pens of so many editors and reporters are engaged in "bearing" gas stocks and berating their owners, to find an artical like the following, cut from a late issue of the *Public Ledger* of this city:

"AN OLD-TIME GAS PANIC."

"As an addendum to the editorial article in this journal a few days ago, concerning the electric light discussion in London and the panic among the holders of gas company shares in that city, growing out of the cable announcement of Edison's discovery of the divisibility of the electric light, we reproduce below an extract from a pamphlet published in London nearly thirty years ago, when a similar panic followed a similar announcement in 1848. So far as we have looked into the London papers of October of this year, while the gas stok scare was raging, no reference was made to the baseless panic that ensued upon the launching of the electric light thirty years ago, yet it must still be in the memory of many Londoners. The pamphlet we refer to was printed in London in 1849, and is entitled "Gas Lighting—Its Progress and its Prospects, etc., etc.," by J. O. N. Rutter, F.R.A.S.

"On page 26 we find the following passage relating to the panic of 1848-9, which so precisely fits the recent London panic as to cause surprise that the London papers did no reproduce it:

"'Very recently how much unnecessary alarm was created by a few cleverly written newspaper paragraphs about the electric light Nothing could more clearly demonstrate the sensitiveness of gas proprietors than their conduct on that occasion. In the largest and most prosperous companies, both in the metropolis and the provinces, shares fell 25 to 30 per cent. in a few days, whilst contracts were deferred, and works actually in progress were hastily suspended. To dispel—or, what is still better, to prevent—needless fear, there is nothing so effective as accurate information. It must, however, be used judiciously, or it will leod astray. If all that was said about the electric light had been true, whould that have been sufficient to justify the sale of gas shares at two-thirds their previous value? Could the use of gas have been so instantly superseded that no breathing-time would have been allowed for gas proprietors to look about them? Great improvements have not hitherto come upon us quite so suddenly. Newspaper paragraphs, attractive advertisements, and provisionally registered companies are fabricated more quickly, and at a cheaper rate, than electric batteries. Whatever partakes of the marvelous, and is least like truth, is the most readily believed. The number of those who permit themselves to be imposed upon is a thousand times greater than of those who ignorantly promulgate error or knowingly practice deception.'"

At no time since the subject of electric light versus gas light has been under consideration has this paper published an article calculated to unduly frighten the timid holder of stock into selling at a sacrifice, or to encourage the adventurer to buy because the price appeared to be low.

It has confined itself to developed facts, leaving the reader to judge of the progress being made, instead of predicting tremendous results on a very slight advance, as most other papers have done, depreciating the value of good stocks, and inflicting loss on many widows, orphans, and aged persons, who can illy afford it; for it is this kind of stockholders who are really the sufferers, knowing, as they do, nothing of the manufacture and distribution of gas, or the difficulties and expenses to be met with and overcome in lighting with electricity.

We who have grown old in the business, and are familiar with it in all its ramifications, and have our eyes open to what is going on and being done, do not take the alaim, and I have the first one yet to meet who has sold a share.

A few weeks ago a great deal was said about the success made in lighting the Centennial Building of the Permanent Exhibition Co. of this city. The gas meters were all removed, and six electric machines, with twenty-two lights, were put in. A couple of weeks or so since the machines were taken out and the meters returned.

The reason given for the change is that the twenty-two electric lights failed to light the building satisfactorily, even when grouped in the centre, with 800 feet "roped" off at each end of the building; while

with gas, at $2.15 per thousand, it is done entirely satisfactorily without increased expense.

These are facts which show just how the matter stands and what progress has been made, and, as a piece of reliable information, I think it will not be void of interest to the readers of the JOURNAL.

Yours truly,
WM. HELME.

Proposed Association of Gas Managers' Assistants.

Mr. Editor:—Accept my thanks for the publication of my letter on the above subject, and for your remarks thereon, contained in the last issue of the JOURNAL.

I trust you will permit me to say a word or two in regard to your proposed improvement upon my scheme.

If it is your idea that the "Juniors" should attend the regular meetings of the Association, I think there would be at least one objection thereto—viz., the great difficulty of the manager and assistant being absent from the works at the same time. And further, I am afraid many members of the Association would feel it a loss of time to listen to a "Junior" express an opinion upon any subject under discussion.

What I would advocate would be either the formation of a separate association, or else the creating of a "Junior Section," with its own officers and meetings distinct from the regular Association. I am confident much good would result therefrom.

ASSISTANT.

Bogus Specs.

THE MUTUAL GAS LIGHT COMPANY TRYING TO KEEP DARK.—MOTION TO COMPEL THE CORPORATION TO EXHIBIT ITS BOOKS, ETC., TO THE PEOPLE IN THEIR ACTION TO WIND IT UP AS FRAUDTLENT.

In Special Term of the Supreme Court this morning, before Mr, Justice Pratt, a motion was made by the People in their suit against the Mutual Gas-Light Company for an order directing the defendant to exhibit to the plaintiff certain books and documents mentioned in the morning papers.

The Hon. Winchester Britton having briefly stated the nature of the motion, Mr. Wheeler H. Peckham, for the defendant, objected to the proceeding on the ground that it was on the petition of Ch. J. Lowery, and not on the petition of the plaintiff.

Mr. Britton replied that Mr. Lowery represented the Attorney General by express authorization.

Mr. Peckham said that Mr. Lowery might have the authority of the Attorney General to sign his name, but the fact was that he had not signed it. Counsel claimed that the affidavit was defective. Furthermore the plaintiff had already served a *subpena duces tecum* on the company, requiring them to produce all the documents mentioned.

At the Court's suggestion Mr. Lowery signed the petition with the name of the Attorney General, "by C. J. Lowery," etc.

THE MERITS.

Mr. Peckham said that as to the merits of the application, it was to the discretion of the Court under a statutory provision, modified by the rules of the Court. All that the petition showed was that issue was joined in July, 1877, and that the cause was on the calendar of the Circuit Court to be called for trial on Nov. 6.

Mr. Britton interposed the remark that for some reason the cause went off the calendar.

Mr. Peckham said that the petition was on information and belief, with the inception of the statement that issue was joined. The petitioner was informed and believed that certain papers and books were in the possession of the defendant, showing its proceedings and transactions, the subscription by capital stock, stock transfers, contracts, a ledger, and so forth, and the sale and hypothecation of stock, all which was material and necessary, and required on the trial of the cause, and that the plaintiff could not proceed to the trial thereof without these papers or books, or sworn copies of them. This was all on which the plaintiff asked the court to decide that these documents were necessary and indispensable, and requisite to be exhibited before trial. The rule of the court provided that the particular facts and circumces showing the materiality and necessity of the information sought should be disclosed, in order that the court might pass on them. T ere was nothing here but the assertion that the corporation kept books. Nor was this a matter of right, as shown by the statute and in 2d Hall. Being an action for a penalty—to seize the franchise for failure to comply with the law—a bill and direction for discovery would never hold. The theory was that the plaintiff must know and have proofs, and the defendant could not be called on to criminate itself. The plaintiff, moreover, did not show that these documents were material, or necessary, or the particular information which was desired. Everything was asked for, and not any particular information. There was consequently, nothing for the Court to pass upon. (Brooklyn Insurance Company vs. Pierce, 7 Hun.) The allegation on information and belief was furthermore insufficient and a *subpena duces tecum* had been issued by which all the facts could be produced on trial (2d Jones & Spencer, 28; Howard, 41; 4th New York Digest, 324.) This was simply a fishing operation by another Brooklyn gas company, and the application ought to be denied.

THE PLAINTIFF'S SIDE.

The Hon. Winchester Britton said that he would like to be informed by his learned friend how, when seeking for the possession of books, they could know positively what was in them. If they knew that, why would they ask to examine the books? It was objected, further, that the petitioner did not specify with sufficient certainty how these documents were germain to the issue. That might be determined on reference to the issue. They asked for a list of stockholders and the books showing the amount of capital stock subscribed for. Would it add to the demand to state the particular item at which they wished to look? The fair inference was that this was what they desired to see. The pleadings were before the court. Here was a corporation created under the laws of this State, one condition being that half the capital stock should be paid in within a certain time, doubtless as a guarantee against bogus companies; if this company was therefore amenable to this charge there was reason to believe it a bogus company. It had not complied with the law the Attorney General said, and it stood in the community as a mere menace. It was therefore the Attorney General's peremptory duty to begin this suit. What was the issue? This only—that one-half the capital stock was not subscribed for and paid in. In view of that the plaintiff asked that the books of subscribers and subscriptions to stock, or copies thereof, be exhibited.

Mr. Justice Pratt said that the defendant claimed that that should appear in the affidavit.

Mr. Britton asked whether it would add to the force or fulness of the affidavit to say that the plaintiff wanted to see these books? As to the matter of discretion, Mr. Britton was not aware of any rule of law that the courts should discriminate against the people when they sought to proceed against a corporation which had not complied with the law. Discretion was governed by rules, and when the court saw that the demand was made

FOR A FAIR PURPOSE,

to prepare for trial, it was just as much bound as though it was a rule of law. It would be difficult to show that the courts leaned in favor of a corporation, when it was charged with the violation of its charter. There was no rule discriminating in favor of wrong against right. The subpena *duces tecum* was issued for November 6, when the cause was set down for trial. It was now found that was insufficient.

Mr. Justice Pratt said it was no waiver of right.

Mr. Britton said that there were no exceptions in sections 803-4-5 in favor of anybody.

Mr. Justice Pratt said that it was not claimed. The question was whether this complied with the Supreme Court rule—that the affidavit should contain such facts as to show that the information sought for was necessary to the trial of the cause.

Mr. Britton said that the affidavit must be read in connection with the pleadings, and when this one issue alone involved, it must be important for the plaintiff to know what they sought. The defendant would not let plaintiff come within four miles of its books and papers.

The Court took the papers and reserved its decision.—*Brooklyn Daily Engle, Nov.* 18.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)

24 PINE STREET, NEW YORK CITY.
NOVEMBER 16, 1878

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Central	466,000	50	—	80
Harlem	$1,800,000	50	30	36
" Bonds	170,000			103
Manhattan	4,000,000	50	145	150
Metropolitan	2,500,000	100	104	108
" Scrip	$1,000,000	..	90	93
Mutual	5,000,000	100	56	63
" Bonds, gold.	900.000	1000	95	101
Municipal	1,500,000	100	75	80
" Bonds	750,000		95	98
New York	4,000,000	100	80	85
Northern	270,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	115	120
Citizens	1,200,000	20	55	60
" Scrip	320,000	1000	90	95
Peoples	2,000,000	10	20	30
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	55	60
Nassau	1,000,000	25	50	56
" Ctfs.	700,000	1000	—	90
Williamsburgh	1,000,000	50	75	85
" Scrip		...	88	92
Kings Co	200,000	100	80	90
Union Co. E N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	101
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	87	91
" " Bds.	124,000	—	105	107
Chicago Gas Co., Ills			128	130
Cincinnati G & C Co				190
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	148
Hempstead, L I	25,000	100	...	—
Jersey City	386,000	20	120	130
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch		20	30	40
New Haven, Conn		25	136	152
Peoples, Jersey City		...	—	85
" " Bds.				95
Peoples of Albany	650,000	100	10	17
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	44	48
" Bonds			106	—
Plainfield, N. J	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Woonsocket, R. I	150,000	100	95	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			95	95½
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97
Washington, D. C		20	—	200
Yonkers		50	70	80

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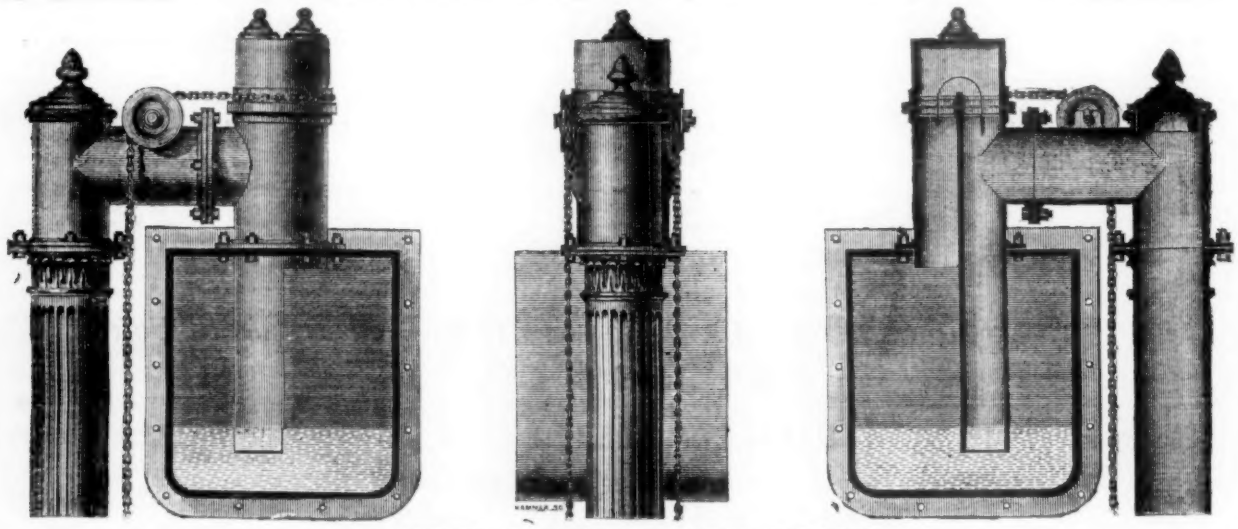

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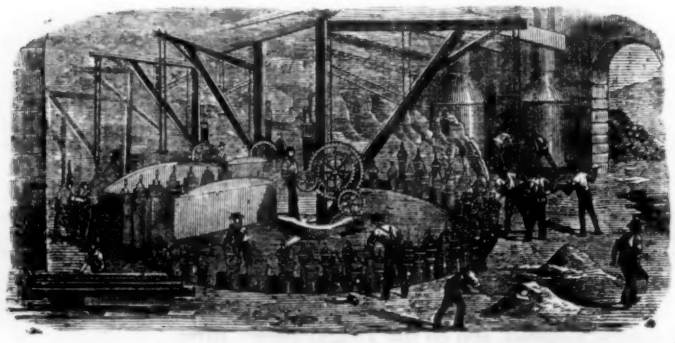

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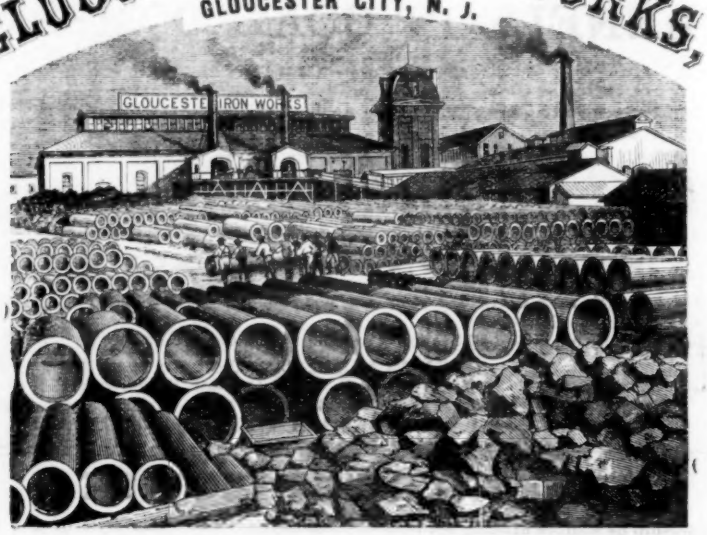

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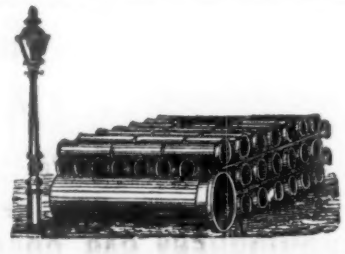

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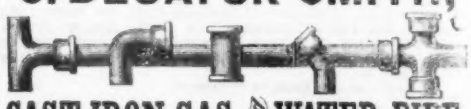

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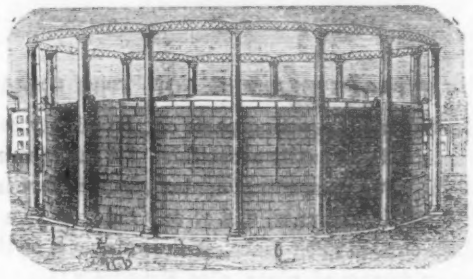

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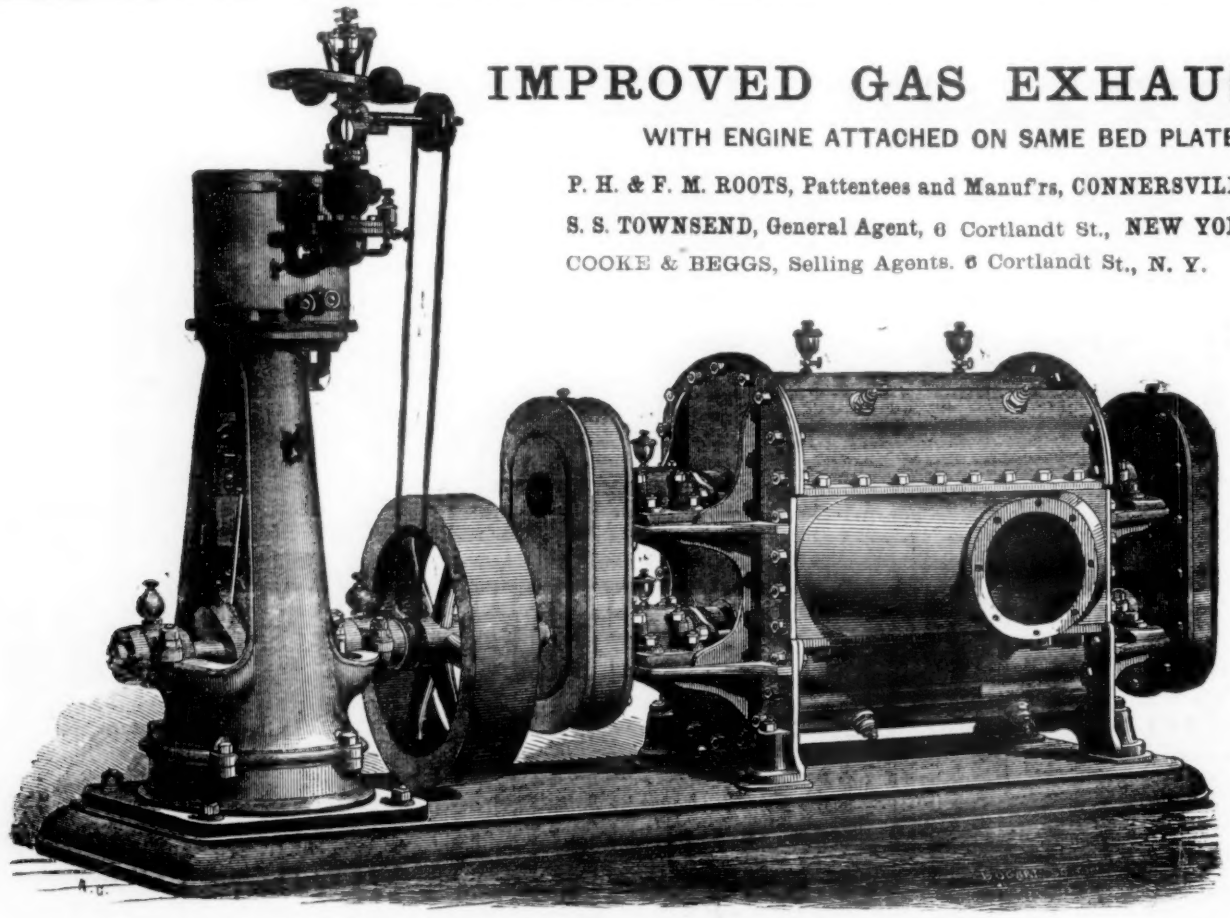

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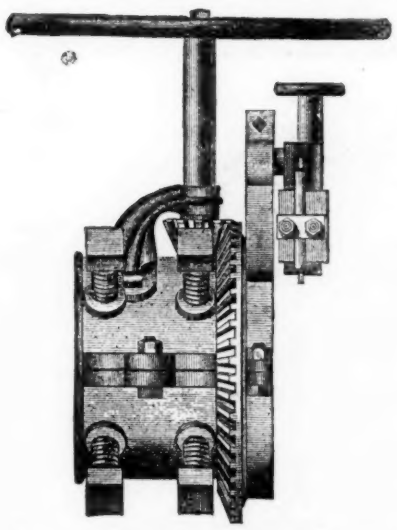

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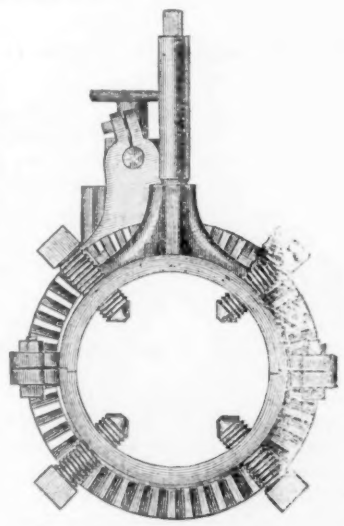

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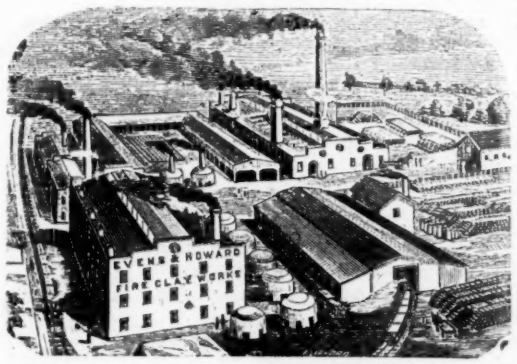

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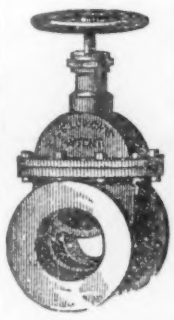

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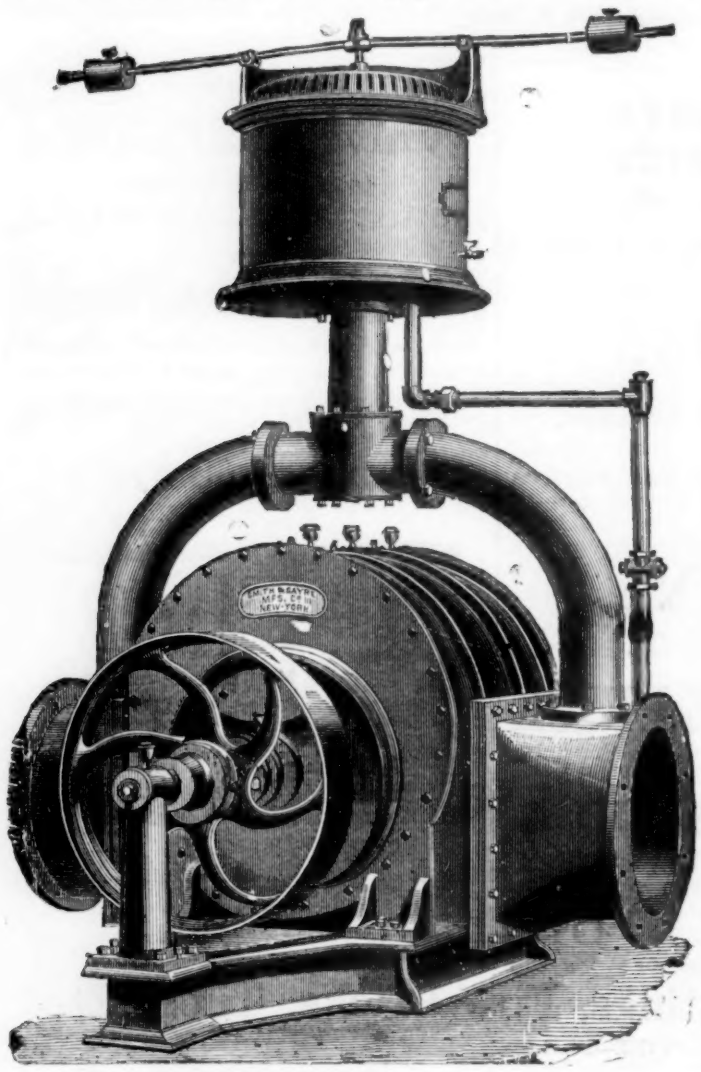

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U. S. CENTENNIAL COMMISSION.

Report of Award to W. W. Goodwin & Co,

The Exhibit consists of a series of Articles for the MEASUREMENT of the QUANTITY of Gas, for the ESTIMATION of the ILLUMINATING POWER, and for TESTING its PURITY. The Articles are RELIABLE in their indications, and so arranged as to be READILY APPLICABLE in PRACTICE. They are ESSENTIAL to the Public Inspector of City Gas.

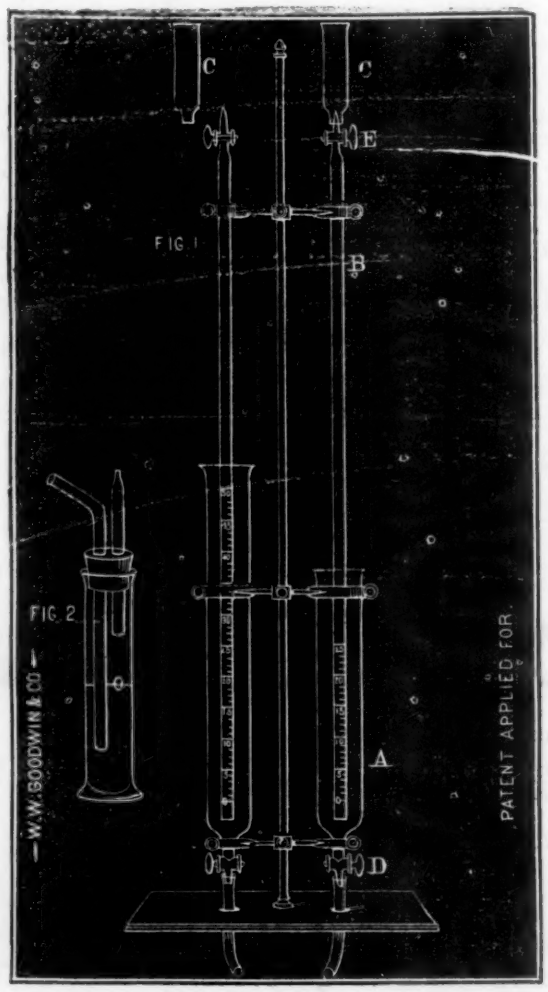
J. R. HAWLEY, Pres't.
J. L. CAMPBELL, Secretary.

A. T. GOSHORN,
Director General.

A NEW METHOD FOR THE ANALYSIS OF COAL GAS

We now have the pleasure of presenting to Gas Companies a new and easy method for the determination of the constituents contained in coal and other gases. The apparatus is so easy of manipulation, that it will come within the reach of any one at all skilled.

Although it does not claim to the greatest degree of accuracy, yet with care a satisfactory result may be obtained, and that too, within a very short time; in fact the principal gases only require a few minutes for their separation and determination of quantity.



The apparatus will determine the presence of the following gases and their quantity:

Ammonia	(NH_3)
Sulp. Hydrogen	(H_2S)
Carbonic Acid	(CO_2)
Air, Oxygen and Nitrogen.	
Bisulp. of Carb.	(CS_2)
Olefiant Gas	(C_2H_4)
Carbonic Oxide	(CO)
Light Carburetted Hydrogen	(CH_4)
Hydrogen	(H)

MANUFACTURED AND FOR SALE BY

WILLIAM W. GOODWIN & CO.